# Multi-Phase Extraction Tests

## 1190505040 -- Madison County -- ILR000128249
## The Hartford Area Hydrocarbon Plume Site
## Hartford, Illinois

*Prepared for:*

**THE HARTFORD WORKING GROUP**

Hartford, Illinois

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## EXECUTIVE SUMMARY

Pursuant to paragraph 43 of the Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) in the matter of The Hartford Area Hydrocarbon Plume Site (Docket No. 7003-5-04-001), this report details the activities and presents the results of multi-phase extraction (MPE) pilot tests conducted within the Village of Hartford, Illinois (Hartford). The tests, requested by the USEPA, were conducted on behalf of the Hartford Working Group (HWG) by Clayton Group Services, Inc. (Clayton) as part of the ongoing investigation activities to enhance petroleum hydrocarbon (hydrocarbon) recovery beneath Hartford. Previous investigations have identified hydrocarbon, whether residual or free-phase in nature, underlying the majority of the northern half of Hartford.

Multi-phase extraction refers to the use of two or more technologies that facilitate the removal of multiple phases of hydrocarbon from the subsurface simultaneously. The hydrocarbon may exist as soil vapor, sorbed to the geologic materials, free-phase liquids floating on the groundwater, or as dissolved constituents within the groundwater.

The purpose for conducting the pilot tests was to determine to what extent the MPE slurping technology, specifically, could enhance removal of previously identified FPH from the groundwater surface, as compared with skimmer pump technology tests previously conducted within Hartford. In addition, the MPE tests provided information for the potential of using vacuum-enhanced recovery of hydrocarbons sorbed to the fine-grained clay and silt materials that comprise the smear zone above the Main Sand. The theory of the MPE pilot tests was to create a pressure gradient, via subsurface vacuum, to induce FPH to flow laterally into the well from the soil matrix where it has been trapped. The total smear zone thickness is approximately 10 feet near the two test locations.

The MPE pilot tests represented the third evaluation of remedial technology considered most appropriate for the Hartford Area Hydrocarbon Plume Site (Site). Previously conducted pilot testing consisted of the above-mentioned skimmer pump technology and of soil vapor extraction (SVE) technology.

The two MPE tests were conducted between May and July 2004 at two separate locations within Hartford. The locations were chosen, as they were considered representative. In general, MPE has been applicable in geologic settings where recoverable FPH has been trapped within a fine-grained matrix such as is generally encountered at the Site north of Date Street. However, it has also been found to be more applicable to geologic settings with limited groundwater (which is not the nature of conditions at the Site). Further, in Clayton's opinion, based on previous pilot testing and the geologic conditions generally encountered to the south of Date Street, the application of soil vapor extraction (SVE) is anticipated to be as effective in the area south of Date Street. Pertinent conclusions of the MPE activities are summarized below:

- The MPE test results suggest that geology, not the remedial technology, is the controlling factor in regards to the removal of FPH from the water surface.

- The fine-grained (clays and silts) smear zone exhibited a low permeability that is not favorable for vacuum-enhanced fluid recovery, even under high vacuums. Furthermore, high vacuums in the recovery wells lifted the water surface above the recovery well screen, resulting in a submerged screen interval that effectively sealed off the smear zone and therefore, eliminated the potential to induce vacuum/air flow from the target area.

- Continuous removal of hydrocarbon and water directly off the surface of the groundwater via MPE did not increase the flow of FPH into the recovery well or any surrounding monitoring wells. All hydrocarbon at both test locations was recovered in a vapor rather than a liquid phase.

- Clayton calculated a TPH removal rate of 6.5 lbs/day or approximately 1 gallon/day at RW-4A and 3.4 lbs/day or approximately 0.5 gallons/day at RW-5. It should be noted that these calculations use the highest influent air stream result to provide a comparison to conventional skimmer pump and SVE pilot tests, and it is likely that

the actual TPH removal rate is lower. In comparison, skimmer pump tests at the Birch Street location (RW-3) recovered approximately 0.8 gallons/day and at the East Cherry Street location (RW-2) recovered approximately 33 gallons/day. TPH removal rates during the SVE Pilot Test were as high as 526 lbs/day or approximately 84 gallons/day.

- Traditional SVE wells screened across the smear zone and terminated above the normal water surface level will be more effective than multi-phase extraction in reducing hydrocarbon trapped within the fine-grained soils.

## 1.0 INTRODUCTION/OBJECTIVE

Pursuant to paragraph 43 of the Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) in the matter of The Hartford Area Hydrocarbon Plume Site (Docket No. 7003-5-04-001), this report details the activities completed as part of two multi-phase extraction (MPE) pilot tests conducted between May and July 2004 within the Village of Hartford, Illinois (Hartford). Clayton Group Services, Inc. (Clayton) was retained by the Hartford Working Group (HWG) to complete these tests, upon the request of the USEPA, as part of the effort to determine the most effective and efficient technology available to remove free-phase hydrocarbons (FPH) from the surface of the water and to extract hydrocarbons from the clays and silts that comprise the smear zone. Previous investigations by Clayton (2004a) and others have identified petroleum hydrocarbon (hydrocarbon), whether residual or free-phase in nature, underlying portions of the northern half of Hartford.

The MPE tests were conducted at two representative locations (Figure 1-1) within Hartford. The MPE pilot tests are the third evaluation of remedial technology under consideration for the Hartford Area Hydrocarbon Plume Site (Site). The two locations are the same areas where Clayton recently completed FPH recovery tests using conventional specific-gravity skimmer pumps. The findings of the skimmer pump tests were presented in the Clayton (2004b) report titled *Free Phase Hydrocarbon Recovery Pilot Test Report*. Prior to the skimmer pump tests, Clayton conducted a soil vapor extraction pilot test at the East Birch Street location, with the results presented in the Clayton (2004c) report titled *Detonation Flame Arrestor Element Replacement & Soil Vapor Extraction Test*.

The MPE pilot test locations were believed to be representative of the northern portions of Hartford, generally north of Date Street, which have a large, fine-grained smear zone. The smear zone within the southern portions of Hartford, generally south of Date Street,

consists of less fine-grained materials and more coarse-grained materials (sand). High vacuums typically generated by MPE technology should not be necessary to reduce trapped residual hydrocarbon within the coarse-grained smear zone. Therefore, the MPE tests were limited to the northern portions of Hartford, north of Date Street.

## 1.1 PRINCIPAL TEST THEORY

When the water surface naturally rises, the hydrocarbon at the surface may infiltrate the overlying fine-grained soils. As the water surface naturally retreats, hydrocarbon may remain "trapped" within these fine-grained materials, resulting in a hydrocarbon smear zone.

Where enhanced FPH and smear zone hydrocarbon recovery from a fine-grained matrix is the primary goal, MPE may be applied. An MPE system is configured to maximize hydrocarbon recovery, minimize groundwater recovery, and extract soil vapor at low-to-medium rates to enhance recovery of FPH from fine-grained materials. This MPE configuration is often referred to as "slurping." Slurping is used to describe the air entrainment and aerodynamic dragging action that lifts the fluids to the surface (Naval Facilities Engineering Service enter, 1998).

The MPE slurping configuration uses vacuum-enhanced fluid recovery by applying a negative pressure to a well, which is intended to increase the flow of product/liquid into the well. The negative pressure is applied to the target zone (i.e., FPH-containing zone) via a high vacuum liquid ring pump or dry claw vacuum pump capable of producing negative pressures (vacuum) of up to 22 inches of mercury. This vacuum can be focused to recover FPH from the surface of the groundwater by inserting a tube ("stinger pipe") within the extraction well. The stinger pipe (with a 45° bottom cut) is positioned so the end of the pipe contacts the FPH floating on the groundwater. The stinger pipe is

designed with flexible piping so the depth can be manually adjusted when groundwater/free product elevation changes.

The pressure gradient created in the subsurface by the high vacuum pump results in a suction-type force on the FPH and is intended to also pull the hydrocarbon laterally through the subsurface. The application of the negative pressure within the well can be expected to improve recovery rates by increasing both FPH transmissivity and hydraulic gradient. The transmissivity is increased due to the decrease in pressure head on the aquifer within the zone of influence. Hydraulic gradient is increased much the same way as if the water surface had been depressed from pumping below the water surface, except the cone of depression is replaced with a zone of reduced pressure around the well. The result is that fluids will flow into the well horizontally across this pressure gradient, rather than into the well via a gravity gradient (i.e., depression cone). Because very little drawdown occurs in the well, potential smearing of FPH is minimized relative to traditional drawdown technologies.

MPE, with vacuum-enhanced pumping, has been found to increase removal of hydrocarbons when used to remediate some petroleum hydrocarbon-impacted sites with fine-grained matrices (Naval Facilities Engineering Service Center, 1998 [Beckett and Huntley, 1998; Parker 1996; Reisinger et al., 1993]). Using model simulations, Beckett and Huntley (1998) demonstrated a recovery increase of nearly 100% when a vacuum was applied to the wellhead. Mathematical models comparing drawdown to slurping (Parker, 1996) have predicted that the FPH removal rate would be three times as fast when using slurping. In field operations at 16 sites, slurping technology increased the light non-aqueous phase liquid (LNAPL) recovery rate by 4 times over that of drawdown pumping and 7 times over that of conventional skimming (Batelle, 1997).

A drawing showing a generalized schematic of the MPE Pilot Test set-up is provided in Figure 1-2.

## 2.0 PILOT TEST LOCATIONS

### 2.1 GEOLOGIC CONDITIONS

The layout of each test location is provided in Figure 2-1 (East Birch Street Test Location) and Figure 2-2 (East Cherry Street Test Location). The primary findings of soil borings at these areas indicate the presence of an alluvial veneer of silts and clays overlying the areally extensive Main Sand. The alluvial silts and clays generally extend to approximately 31 to 34 feet below ground surface (bgs) at the East Birch Street location and approximately 29 to 30 feet bgs at the East Cherry Street location. The upper 9 to 18 feet of these alluvial deposits consists of relatively impermeable silty clays. Within the alluvial deposits below these clays, more permeable strata (e.g., North Olive and Rand stratum) are found. The more permeable strata exhibit spatial variability, ranging from sandy silt, silt with sand or clayey silts with sand. The deeper, more permeable stratum was generally separated from the Main Sand by a relatively thin lean clay or silty clay layer approximately 2 to 6 feet in thickness. The total smear zone thickness is approximately 10 feet near the two test locations. Generalized cross sections of these areas are presented in Figure 2-3 (East Birch Street test location) and Figure 2-4 (East Cherry Street test location).

### 2.2 WELLS AND EQUIPMENT INSTALLATION

An Illinois Environmental Protection Agency (Illinois EPA) Bureau of Air "Joint Construction and Operating Permit" was issued for the performance of the MPE pilot tests (Illinois EPA permit No. 119050AAS). All test activities were conducted within the specifications and guidelines of this permit. The Illinois EPA air permit for the test has been provided in Appendix A.

As previously stated, the MPE pilot tests were conducted at two locations within Hartford (Figure 1-1). The first test was completed at RW-4A (this well replaces RW-4) within a vacant gravel lot (owned by Premcor Refining Group) located at the southeast corner of East Birch Street and North Market Street. The second pilot test was completed at RW-5 located in a vacant grassy lot (also owned by Premcor) at the southwest corner of North Olive Street and East Cherry Street. The MPE wells were installed in each of the test locations to remove FPH from the surface of the water and to extract air/vapors from the fine-grained materials (clays and silts) that comprise the smear zone. Vacuum monitoring probes were used to measure subsurface vacuum responses generated at select radial distances from the new MPE extraction wells. The locations of the MPE extraction wells and vacuum monitoring probes have been provided in Figures 2-1 and 2-2.

The extraction wells were constructed of 4-inch inside diameter (ID), Schedule 40 polyvinyl chloride (PVC) well screen (0.020-inch slot) and riser pipe. The total well depth and screening interval was determined based on a review of historic water depths within Hartford. It was the intent of the well construction to have several feet of screen above the static water surface to allow for the previously described "suction-type force" to be placed on the clays and silts of the smear zone and to "pull" hydrocarbon laterally through this material into the well. At each location, the screen was situated to intersect the average water surface depth (~33 feet below ground surface [bgs]) and the overlying smear zone (to 20 feet bgs). For this reason, the MPE wells were installed with a 20 or 25-foot screen situated between 19 and 44 feet bgs. The boring logs for these MPE wells have been provided in Appendix B.

The vacuum monitoring probes (MP-6S through MP-9S, and MP-6D through MP-9D) at the East Birch Street location (RW-4A) consisted of 1-inch ID, Schedule 40, PVC screen (0.010-inch slot). The monitoring probes were previously installed by Clayton (2004c) as part of an earlier SVE pilot test and existed in sets of "nests" situated at select radial

distances from the extraction well (Figure 2-1). Each nest consisted of two distinct subsurface monitoring points (screened intervals). The purpose of the probe nests was to measure vacuum within two distinct subsurface units. The screened intervals of the probes were situated to correspond with the deeper (Main Sand) unit and the overlying (fine-grained clays/silts) alluvial material. The shallow probes were constructed with screened intervals between 5 to 10 feet bgs. Screened intervals for the deep probes were between 17 to 27 feet bgs.

For the East Cherry Street MPE test (RW-5), four new vacuum monitoring probes (MP-25 through and MP-28) were installed to allow for collection of subsurface vacuum measurement readings throughout the test. These vacuum monitoring probes were constructed using 2-inch ID, Schedule 40, PVC screen (0.010-inch slot). The probes were screened from approximately 14 to 29 feet bgs (above the top of the Main Sand). Shallow probes were not installed as part of the East Cherry Street MPE test (RW-5) because shallow vacuum influence was not observed in similar fine-grained soils during the East Birch Street MPE (RW-4A) test or during the SVE pilot test at HSVE-1, also at East Birch Street (Clayton 2004c). The boring logs and well completion reports for the vacuum monitoring probes at each test location are provided in Appendix C-1.

In addition, at both test locations, monitoring wells were installed at select radial distances from each MPE well to measure FPH thickness (if present) and water level throughout the tests (Figures 2-1 and 2-2). The monitoring wells were screened similar to the MPE wells (with a screen interval between 20 and 40 feet bgs). The boring logs and well completion reports for the monitoring wells are provided in Appendix C-2. A pressure transducer was installed below the water level within each monitoring well to allow for automatic recording of water levels changes at select intervals (every 2 minutes for the East Birch Street test, and every 15 minutes for the East Cherry Street test). The data collected from these transducers provided information regarding the MPE test on the

water level. FPH thickness readings (if present) were manually collected from each monitoring well using an oil/water interface probe.

The tests were conducted using a mobile trailer-mounted MPE module that included a 7.5 horsepower (hp) explosion-proof motor with a three-phase dry claw vacuum pump capable of achieving 165 scfm at 24 inches of Hg. The performance specifications and curve for the blower are provided in Appendix D. The MPE module included a 50-gallon water trap/knock out with demister/filter, an exhaust silencer, and a manual air dilution valve (ADV). The ADV controlled flow rates/vacuums at the extraction well by introducing ambient air into the air stream. Additional process control features such as float switches, flow gauges, and vacuum relief valves were integrated within the MPE module to optimize pump performance.

For each of the tests, the MPE module was situated adjacent to extraction well. The top of each extraction well was then connected to the inlet of the MPE module using 1-inch ID, high-vacuum, flexible PVC hose. A 20-foot length of 0.5-inch ID PVC stinger pipe was placed within each well and secured to the well cap via a rubber Fernco coupling and reducer fitting. Prior to placement within the well, the stinger pipe was fitted through the well cap equipped with a 0.5-inch hole to allow the stinger pipe to penetrate. The stinger pipe was locked into position using clamps and rubber bushings to prevent air intrusion and potential vacuum loss. The well cap was also retrofitted with an air inlet port to provide for manual control of vacuum generated within the well.

The MPE module exhaust was routed through an electrically heated catalytic oxidizer capable of providing 99% hydrocarbon destruction efficiency. The oxidizer was equipped with a real time temperature LED readout, and a strip chart recorder to continually plot the catalyst temperature and oxidizer efficiency. The oxidizer and the MPE module were interlocked to ensure shutdown of the MPE module if the oxidizer catalyst center temperatures dropped below 1,050°F.

Liquids recovered during the tests were routed to a 5,000-gallon aboveground storage tank (AST) provided with secondary containment. The AST was equipped with a high-level float switch and was interlocked with the MPE module and oxidizer to shut down the test given a "tank full" condition. The MPE module and oxidizer could only be manually restarted once the AST was emptied and the "tank full" condition was reset. Figure 1-2 shows a generalized schematic of the MPE pilot test set-up.

## 3.0 PILOT TEST OPERATION

The MPE pilot test was conducted until it was determined that sufficient and appropriate data were collected to enable an evaluation of the effectiveness of this technology for hydrocarbon recovery within Hartford. At the East Birch Street location the test was begun on May 17, 2004 at RW-4. At test startup, it was realized that the well screen of RW-4 was plugged. Therefore, the test equipment was switched to RW-3 (recovery well installed in the 1990's for which no well construction information is available). The test continued at RW-3 until June 7, 2004 at which time a new recovery well (RW-4A) was installed. The test resumed at RW-4A on June 11, 2004 and continued until June 30, 2004. The East Cherry Street test (RW-5) was conducted for a shorter period of 19 days (July 12 to 30, 2004) due to similar results as those obtained from the East Birch Street test.

At each location, FPH product skimming was suspended approximately 30 days prior to beginning the MPE test. This allowed the FPH thickness in the recovery wells to equilibrate to static conditions similar to those observed before the FPH skimmer tests.

Prior to the test initiation, the MPE module was operated with the ADV completely open to evaluate the operation of the equipment and perform any necessary maintenance prior to initiating the test. During this time, all flow, pressure, and temperature gauges were calibrated.

In order to establish baseline subsurface pressure data, pressure readings were collected from all of the subsurface vacuum monitoring probes prior to the start of each test. None of the vacuum monitoring probes exhibited pressure readings above/below 0.0 inches of water column (W.C.). In addition, the pressure transducers placed in the monitoring wells were set to collect automatic water level readings several hours before the start of each test.

The slurping was started to initially remove all FPH from the extraction well. This was accomplished by placing the end of the stinger pipe within the extraction well at the surface of the static liquid level. The end of the stinger pipe was cut to leave a 45-degree angle on the pipe. Only the tip of the pipe (top part of the angle) was set in the hydrocarbon, with the remaining portion open to air to create a vacuum within the well and on the surrounding clays and silts of the smear zone. At this same time, an oil/water interface probe was placed within the well to monitor hydrocarbon thickness and water levels.

The influent air stream passed through a knockout vessel to separate vapor and liquids. Liquids were "knocked-out" from the influent air stream and stored within the knockout vessel. When the vessel became full, the liquids were automatically pumped (via a transfer pump) to the adjacent AST. Due to the slow influent recovery rate of actual FPH (and therefore the subsequent period required to fill the knockout pot) and given the cyclonic action of the air stream within the knockout vessel, the FPH was being volatilized before it could accumulate within the knockout pot.

The dry air stream exited the knockout vessel and was continually scanned using a Photovac photoionization detector (PID) equipped with a 10.6 electron volt (eV) probe. The PID, calibrated to an isobutylene standard, measures total concentrations of organic vapors. The PID cannot identify or quantify specific components. The PID was programmed to record air stream hydrocarbon concentrations (ppmv) every 15 minutes throughout the test. The PID also provided visual real time readings (every 3 seconds) of the influent air stream hydrocarbon concentration throughout the test.

Once all FPH had been removed from the well, the vacuum within the well was increased (by incrementally closing the ADV and well cap vent port) to try and "pull" (vacuum-enhanced recovery) hydrocarbon out of the smear zone materials (clays and silts) into the well. At this same time, an oil/water interface probe was utilized to

determine if hydrocarbon was being "pulled" into the well (and if so, at what rate) and to determine what effect the increase in well vacuum was having on water levels (within the well). It was imperative to keep the water levels below the top of the screen interval in order to allow for a zone of reduced pressure to occur within the smear zone. Vacuum response readings were periodically recorded at each vacuum monitoring probe to measure for the presence of a vacuum within the subsurface materials.

Air samples were also periodically collected from the exhaust air stream (prior to oxidizer) using 1-liter tedlar bags. At the same time, influent airflow rates, exhaust airflow rates, and wellhead vacuum readings were recorded. The tedlar bag samples were submitted to Columbia Analytical Services, Inc. in Simi Valley, California for United States Environmental Protection Agency (USEPA) Method TO-3 (total petroleum hydrocarbons [TPH] as gasoline) and methane. The samples were shipped overnight delivery and the laboratory analyzed the samples within 24 hours.

Following completion of this vacuum-enhanced FPH recovery portion of the test, the well cap air inlet port was opened to reduce vacuum within the well. However, the ADV remained partially closed to provide for a vacuum to exist at the tip of the stinger pipe. This action resulted in a skimming of liquids from the surface of the water without generating any significant vacuum within the well itself. The intent here was to pull FPH into the well along the water surface. The vacuum within the stinger pipe was strictly used to lift the hydrocarbon/water to the surface and not to "pull" hydrocarbon from the smear zone.

## 4.0 DATA COLLECTION

The operating parameters of the MPE module and select field test parameters were measured at regular intervals during each test. The operating parameters of the MPE module and the field test parameters measured are listed below:

- Vacuum at the extraction well.
- Vacuum at the inlet to the vapor/liquid separator.
- Airflow rate on the dilution air at wellhead.
- Airflow rate downstream of the vapor/liquid separator.
- Relative organic vapor concentration of the exhaust air stream (after vapor/liquid separation).
- Airflow rate and temperature of the exhaust air stream from blower.
- Temperature of the exhaust air stream across and after the catalytic oxidizer.
- Groundwater elevation response at each piezometer (via pressure transducers and datalogger).
- Volume of water/product separated from vapor phase.
- Depth to water and product in both test well and piezometers prior to step test.
- Depth to water and product in both test well and piezometers periodically throughout the test and immediately following the step test.
- Vacuum response at each vacuum monitoring probe.

The total influent airflow rate was measured to determine the potential subsurface airflow conditions at the extraction well. This velocity was measured using a pitot tube connected to a Magnehelic gauge to measure differential pressure. The airflow velocity

was then converted to a standard airflow rate based on the cross-sectional area of the process pipe and a standard air density of 0.075 lbs/ft$^3$.

The vacuum, total (exhaust) airflow rate, and exhaust temperature at the MPE unit were measured to determine the performance of the blower relative to the subsurface soils and extraction well design, the airflow loss between the extraction well and inlet of the MPE unit, and the overall operating system performance. The airflow velocity of the exhaust air stream was measured using a pitot tube connected to a Magnehelic gauge to measure differential pressure (as previously described with the influent airflow rate). The vacuum was measured directly using a vacuum gauge tapped into the water trap (post ADV) of the MPE unit.

The vacuum response was measured at each vapor monitoring probe to determine the vacuum distribution or radius of influence (ROI) of the extraction well. The vacuum levels were measured using Magnehelic negative pressure gauges attached to the top of each monitoring probe with a quick-connect air lock fitting. The accuracy of the vacuum gauges is approximately ± 0.02 inches of W.C.

## 5.0 MPE PILOT TEST RESULTS

Performance data collected from the MPE module, field test measurements, and analytical results of the air samples were evaluated during and following the completion of the pilot tests. The data generated during the pilot test provided a basis of comparison between conventional skimming pumps and vacuum-enhanced pumping technologies for hydrocarbon recovery within Hartford. A summary of operational parameters is provided in Tables 5-1 (East Birch Street test location) and 5-2 (East Cherry Street test location).

### 5.1 EXTRACTION WELL VACUUM/WATER LEVEL

The relationship between vacuums measured within the extraction wells and the corresponding water level within the well turned out to be the critical data point of these tests. High vacuums (8 to 20 inch Hg) within the extraction well (at relatively low airflow rates of 10 to 20 cfm), resulted in lifting the water column above the well screen and sealing off any potential for airflow/vacuum production within the smear zone. These high vacuums were generated as a result of the fine-grained nature of the clays and silts that comprise the smear zone and the rise of the water level in the more permeable unit.

### 5.2 MONITORING WELL HYDROCARBON THICKNESS AND WATER LEVEL

At no period during either of the MPE tests were there recognizable trends or indications of FPH being pulled toward the extraction well. The presence and thickness of FPH within the surrounding monitoring wells appeared to be random and localized. The activities of these tests did not produce any increase in hydrocarbon thickness in either of the extraction wells themselves or the surrounding monitoring wells. Changes in FPH thickness within the surrounding monitoring wells during the tests was believed to be a

result of fluctuating water surface rather than a result of the test itself (Figures 5-1 through 5-9). In fact, only one monitoring well (HMW-33), which had no product prior to the test, exhibited accumulation of product during this test. Since the other wells in closer vicinity to the extraction well exhibited no product at all, the increase of hydrocarbon thickness within this well was believed to be unrelated to the test and may have been a function of the increase in water surface elevations observed during the test (and precipitation events during the East Birch Street test).

## 5.3 VACUUM RESPONSE AND RADIUS OF INFLUENCE (ROI)

The vacuum response at each vacuum monitoring probe was recorded to determine the vacuum distribution in the subsurface soils and ROI during various test conditions (especially the vacuum-enhanced portions of the test). The effective ROI is defined in the literature as the distance at which air is advectively drawn towards the extraction well at a rate that will effectively remove contaminants from the soil. The steady-state vacuum response measurements at the vacuum monitoring probes under the various test conditions are listed in Table 5-1 (East Birch Street test location) and Table 5-2 (East Cherry Street test location).

Vacuum readings ($\geq$ 0.1 in. W.C.) were not detected in any of the monitoring probe locations during either test. The lack of vacuum response within these probes is a direct result of the previously described relationship between the well vacuum and the corresponding water column in the well.

## 5.4 AIR SAMPLE ANALYTICAL RESULTS

To quantify the removal of specific volatile organic compounds (VOCs) from the soils during the pilot test, air samples were collected from the exhaust air stream (prior to oxidizer) using 1-liter tedlar bags. At this same time, influent airflow rates, exhaust

airflow rates, and wellhead vacuum readings were recorded. The tedlar bag samples were submitted to Columbia Analytical Services for USEPA Method TO-3 (TPH as gasoline) and methane. Table 5-3 provides a summary of the air sample analytical results.

## 5.5 HYDROCARBON EXTRACTION RATES

The removal rate of TPH (in lbs TPH/day) during the MPE pilot test was calculated from the TPH concentration (ppmv) detected in an inlet air stream sample (tedlar bag samples).

The TPH removal rate $R_r$ (in lbs/day) was determined using the following calculation:

> $R_r = C_v \times Q_s$ (where $C_v$ is the known concentration of TPH in the air sample and $Q_s$ is the measured influent air stream flow rate at the time the sample was collected)
>
> To calculate the removal rate ($R_r$) in lbs/day, the concentration and the flow rate were multiplied by the molecular weight of gasoline (66 lbs./lbs.-mole) and a constant to convert the concentration into pounds per day as follows:
>
> $R_r = C_v \times Q_s \times MW_{gasoline} \times 1.581 \times 10^{-7}$
>
> Where the constant has units of [(lbs.-mole min)/$ft^3$ ppm-v hr)] and was derived as follows:
>
> $(1/10^{-6}$ ppm-v) x (60 min/1 hr) x (1 lb-mole/379.5 $ft^3$) = $1.581 \times 10^{-7}$

Using the above-referenced calculations and the highest influent air stream laboratory analytical result, a TPH removal rate was calculated. At RW-4A the average flow rate was approximately 60 $ft^3$/min and the highest TPH analytical result was 430 ppmV. Using these values, the calculated removal rate at RW-4A is 0.27 lbs/hour or 6.5 lbs/day. At RW-5 the average flow rate was approximately 85 $ft^3$/min and the highest TPH analytical result was 160 ppmV. Using these values, the calculated removal rate at RW-5 is 0.14 lbs/hour or 3.4 lbs/day. A hand calculation of the TPH removal rate at RW-4A is

presented in Appendix E. The laboratory reports for the air samples are included in Appendix F with a summary of the analytical results presented in Table 5-3.

It should be noted that these calculations use the highest influent air stream result to provide a conservative comparison to conventional skimmer pump and SVE pilot tests, and it is likely that the actual TPH removal rate is lower. A rough conversion of the TPH removal rate in lbs/day to gallons/day assumes that there are 6.25 lbs of gasoline in a gallon of gasoline. This yields a removal rate of approximately 1 gallon/day at RW-4A and approximately 0.5 gallons/day at RW-5. The test was run for 40 days at RW-4A. Therefore, approximately 40 gallons of gasoline was removed during the test at RW-4A. The test ran for 19 days at RW-5. Therefore, approximately 9.5 gallons of gasoline was removed during the test at RW-5.

## 6.0 SUMMARY OF RESULTS

Evaluation of the MPE pilot test data generated the following conclusions:

- The MPE test results suggest that geology, not the remedial technology, is the controlling factor in regards to the removal of FPH from the water surface. The MPE test results suggest that the majority of hydrocarbon within the subsurface exists as hydrocarbon trapped in the fine-grained materials of the smear zone. The presence and thickness of FPH within monitoring wells appears to be a function of a variety of factors including a fluctuating water surface and the presence of hydrocarbon trapped in the smear zone. It appears that under normal conditions, the adsorbed hydrocarbon remains within the fine-grained clays and silts and can flow freely into monitoring/ recovery wells only when rising water levels physically displace the hydrocarbon.

- Continuous removal of hydrocarbon and water directly off the surface of the groundwater via MPE did not increase the flow of FPH into the recovery wells or any surrounding monitoring wells. All of the hydrocarbon at both test locations was recovered in a vapor rather than a liquid phase.

- The fine-grained (clays and silts) smear zone exhibited a low permeability that is not favorable for vacuum-enhanced fluid recovery, even under high vacuums. Furthermore, high vacuums in the recovery wells raised the water surface above the recovery well screen (due to the soil permeability), resulting in a submerged screen interval that effectively sealed off the smear zone and therefore, eliminated the potential to induce vacuum/air flow from the target area. This occurred despite screen placement from approximately 19 to 44 feet bgs at each test location where the water surface has been at a depth of approximately 30 feet bgs. Therefore, the MPE pilot tests indicated that creating a pressure gradient (via subsurface vacuum) to induce hydrocarbon to flow laterally into the well was not possible due to the geologic conditions.

- Clayton calculated a TPH removal rate of 6.5 lbs/day or approximately 1 gallon/day at RW-4A and 3.4 lbs/day or approximately 0.5 gallons/day at RW-5. It should be noted that these calculations use the highest influent air stream result to provide a comparison to conventional skimmer pump and SVE pilot tests, and it is likely that the actual TPH removal rate is lower. In comparison, skimmer pump tests at the Birch Street location (RW-3) recovered approximately 0.8 gallons/day and at the East Cherry Street location (RW-2) recovered approximately 33 gallons/day. TPH removal rates during the SVE Pilot Test were as high as 526 lbs/day or approximately 84 gallons/day.

- Traditional SVE wells screened across the smear zone and terminated above the normal water surface level will be more effective than multi-phase extraction in reducing hydrocarbon trapped within the fine-grained soils.

## 7.0 REFERENCES


Batelle. 1997. *Engineering Evaluation and Cost Analysis for Bioslurper Initiative*. Batelle Columbus Operations, Columbus, Ohio

Beckett, G.D. and D. Huntley. 1998. *Soil Properties and Design Factors Influencing Free-Phase Hydrocarbon Cleanup*. Environ. Sci. Technol, 32(2):287-293

Clayton Group Services, Inc., April 8, 2004a. *FPH CPT/ROST™ Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois*. Clayton Project No. 15-03095.14.003

Clayton Group Services, Inc., May 13, 2004b. *Free Phase Hydrocarbon Recovery Pilot Test Report*. Clayton Project No. 15-03095.13-001

Clayton Group Services, Inc., March 4, 2004c. *Detonation Flame Arrestor Element Replacement & Soil Vapor Extraction Test*. Clayton Project No. 15-03095.13.001.

Naval Facilities Engineering Service Center, October 1998. "Application Guide For Bioslurping, Volume I, Summary and Principals and Practices of Bioslurping." *Technical Memorandum TM-2300-ENV*. Port Hueneme, California.

Parker, J.C. 1996. "Evaluating the Effectiveness of Product Recovery, Bioventing, and Bioslurping Systems." *Environmental Systems and Technology, Inc. News, 4*. (Winter 95, 4-6) Blacksburg, Virginia.

Reisenger, H.J., P. Hubbard, S.A. Mountain, and C.W. Brigham. 1993. *Integrated Site Remediation System Using High Vacuum Application to Address Groundwater Extraction, Soil Venting, and In Situ Biodegradation*. Presented at EPA Groundwater Remediation/Stabilization Conference, Atlanta, Georgia, December 1-3.

United States Environmental Protection Agency, Region 5, Chicago, Illinois. *In the Matter of the Hartford Area Hydrocarbon Plume Site*. (Docket No. R7003-5-04-001).

# FIGURES

# TABLES

# APPENDIX A

## ILLINOIS EPA AIR PERMIT

# APPENDIX B

## EXTRACTION WELL LOGS
## (RW-4, RW-4A and RW-5)

# APPENDIX C

## MONITORING PROBE/ MONITORING WELL LOGS

# APPENDIX C-1

# MONITORING PROBE LOGS

# APPENDIX C-2

# MONITORING WELL LOGS

# APPENDIX D

## BLOWER PERFORMANCE SPECIFICATIONS

# APPENDIX E

## HAND CALCULATIONS FOR HYDROCARBON REMOVAL RATES

# APPENDIX F

## AIR SAMPLE ANALYTICAL RESULTS

**Figure 5-9: Hartford Working Group MPE Pilot Test -
Monitoring Well HMW-34**

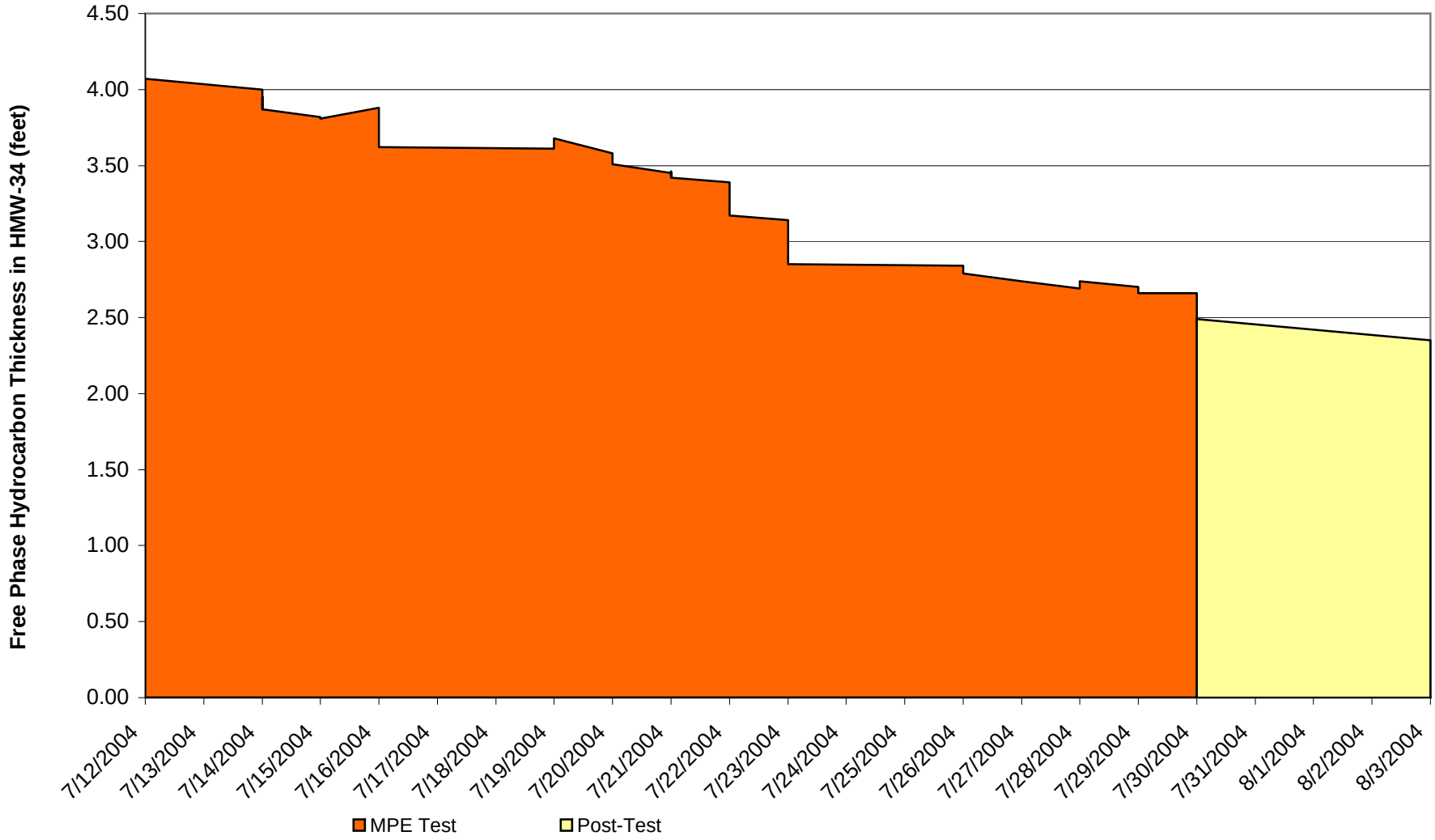


**Figure 5-8: Hartford Working Group MPE Pilot Test -
Recovery Well RW-2**

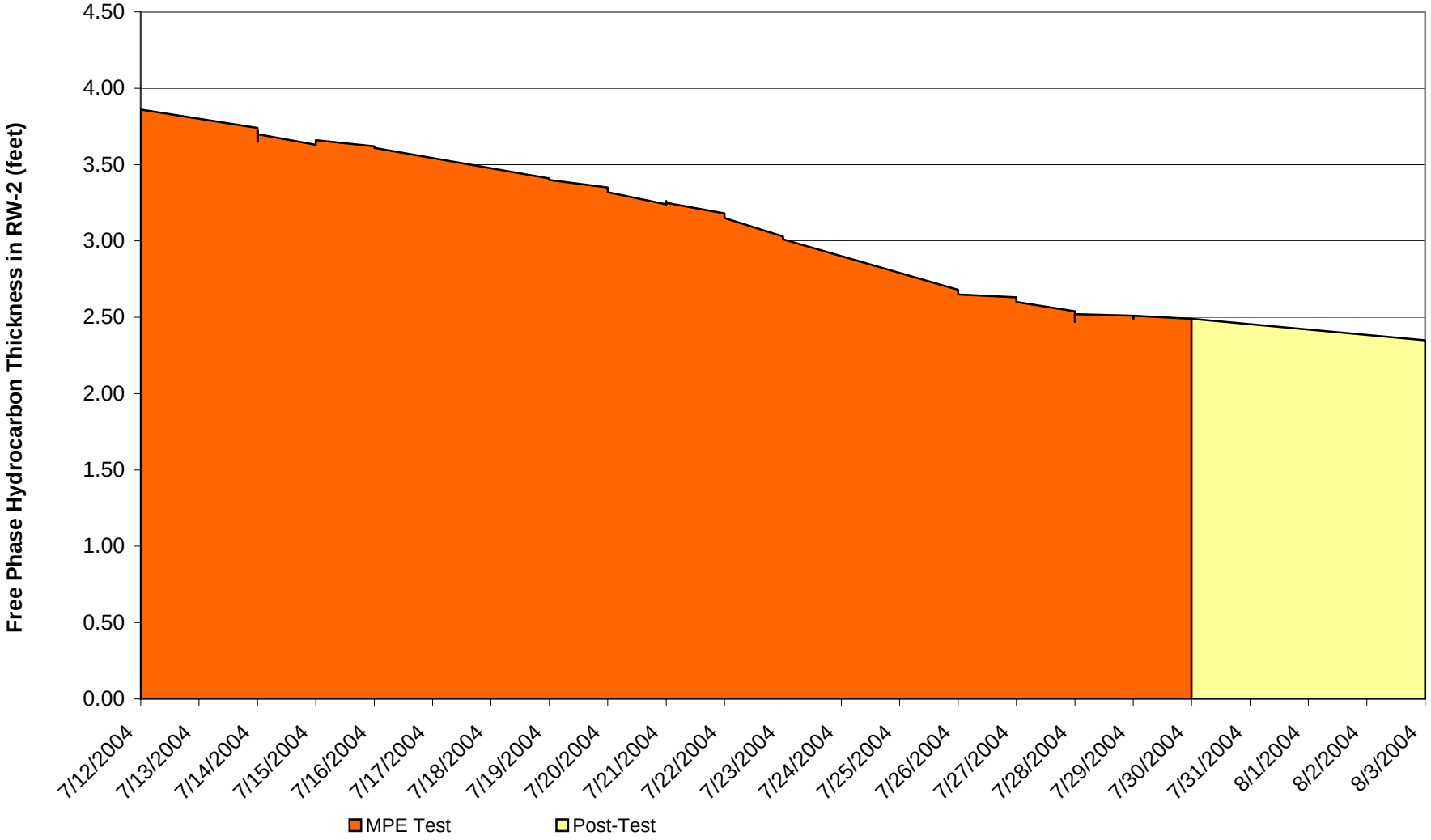


**Figure 5-7: HMW-35 Transducer Water Level Data**

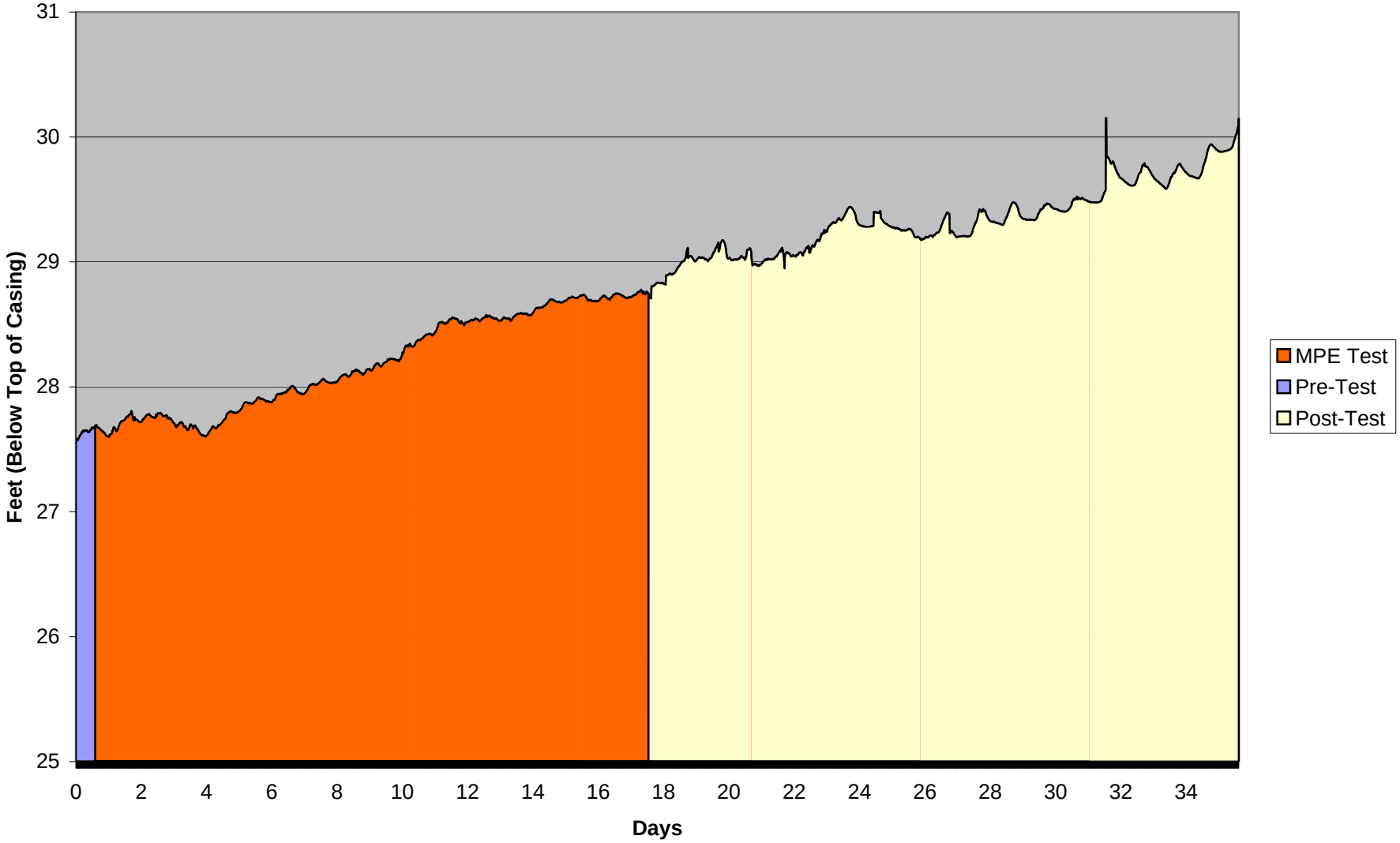


**Figure 5-6: HMW-34 Transducer Water Level Data**

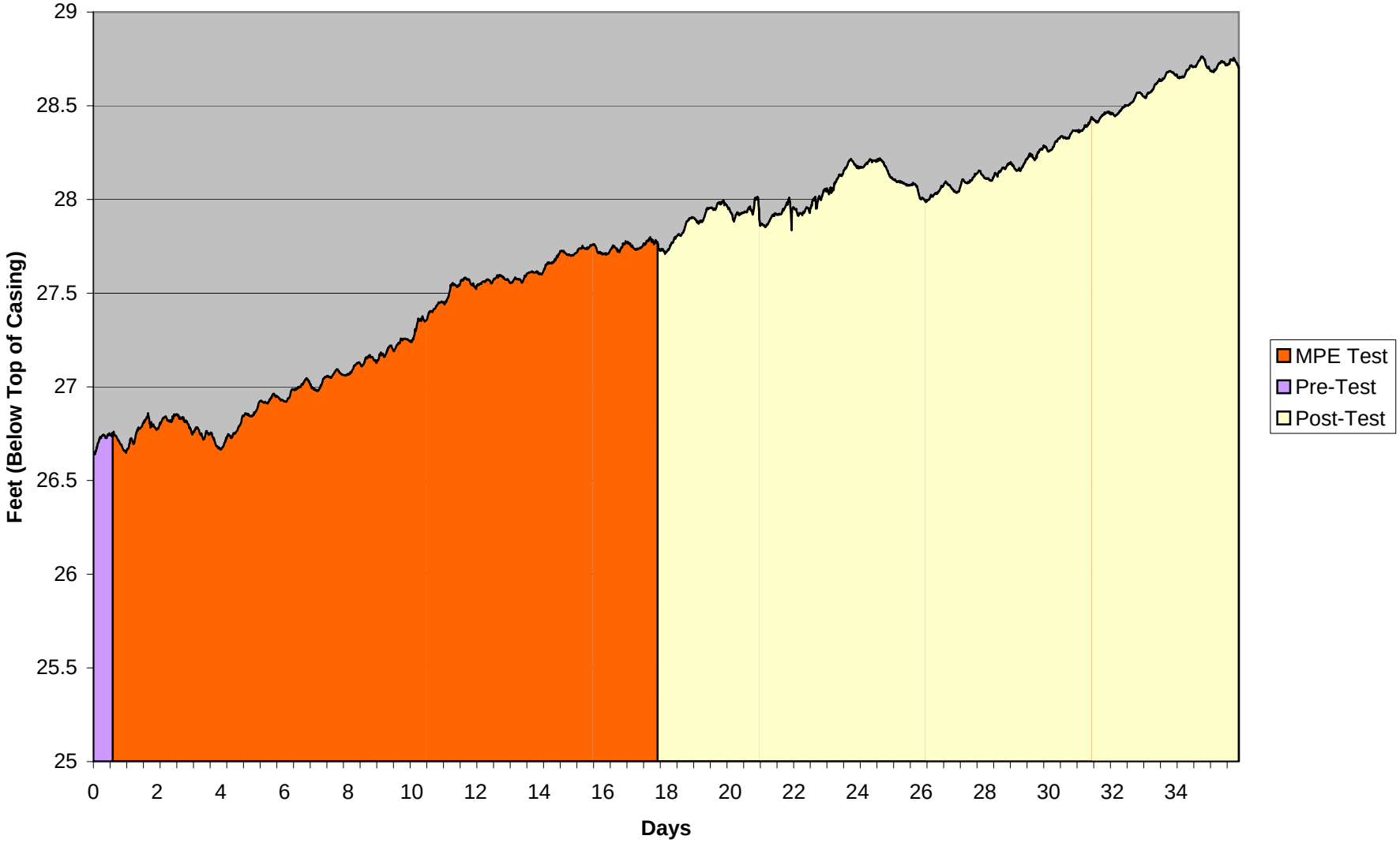


**Figure 5-5: Hartford Working Group MPE Pilot Test -
Monitoring Well HMW-8**

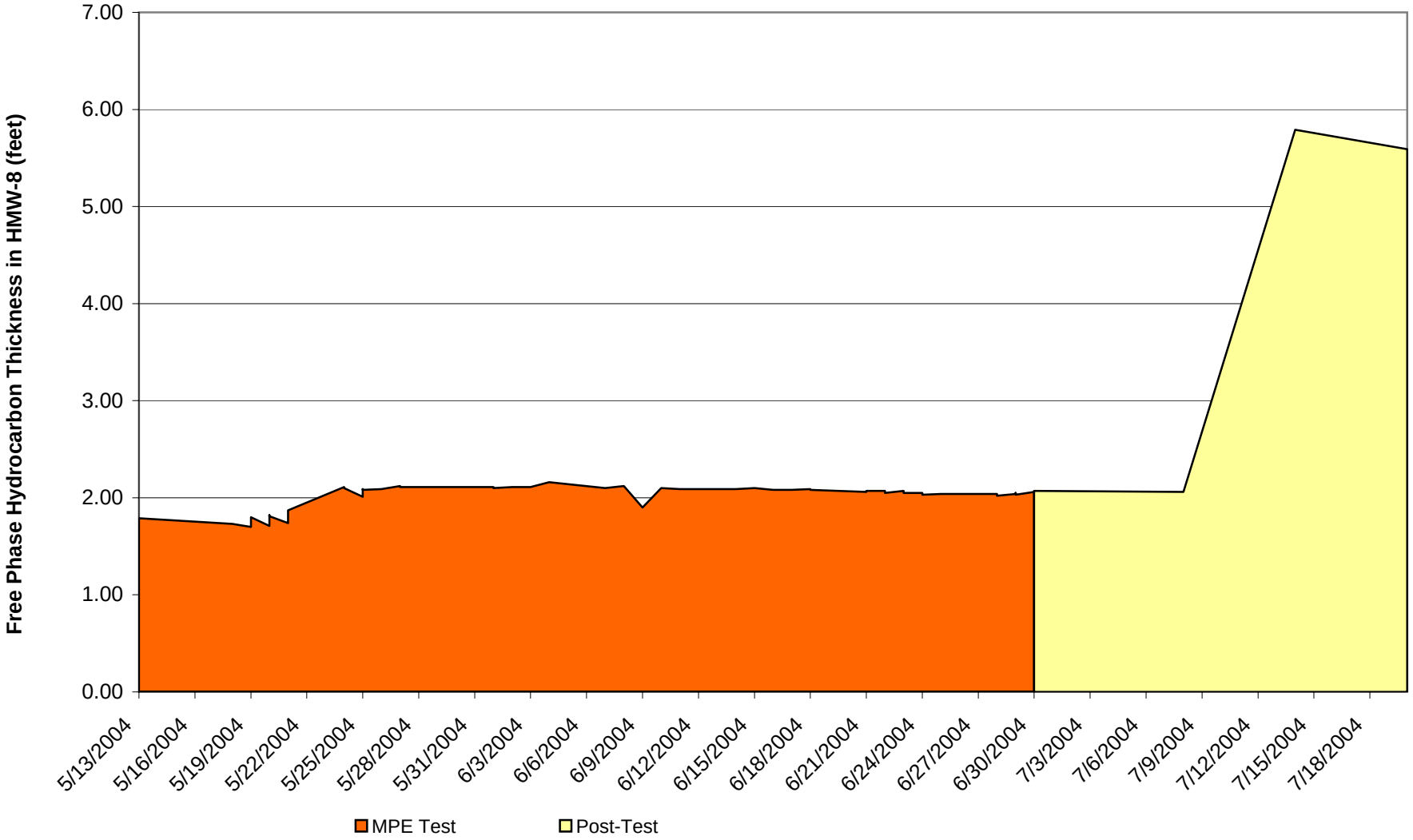


**Figure 5-4: Hartford Working Group MPE Pilot Test - Monitoring Well HMW-22**

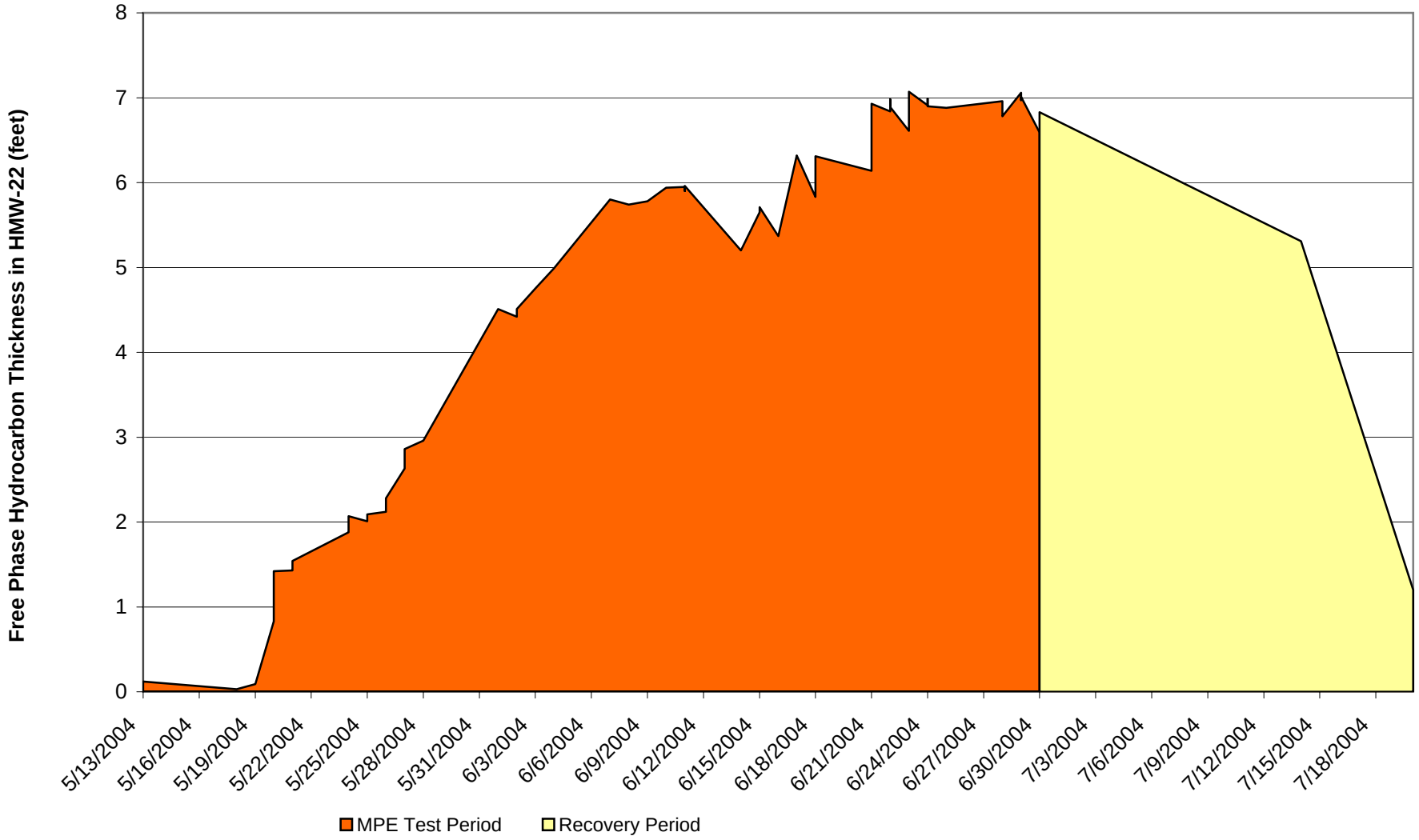


**Figure 5-3: Hartford Working Group MPE Pilot Test - Monitoring Well HMW-33**

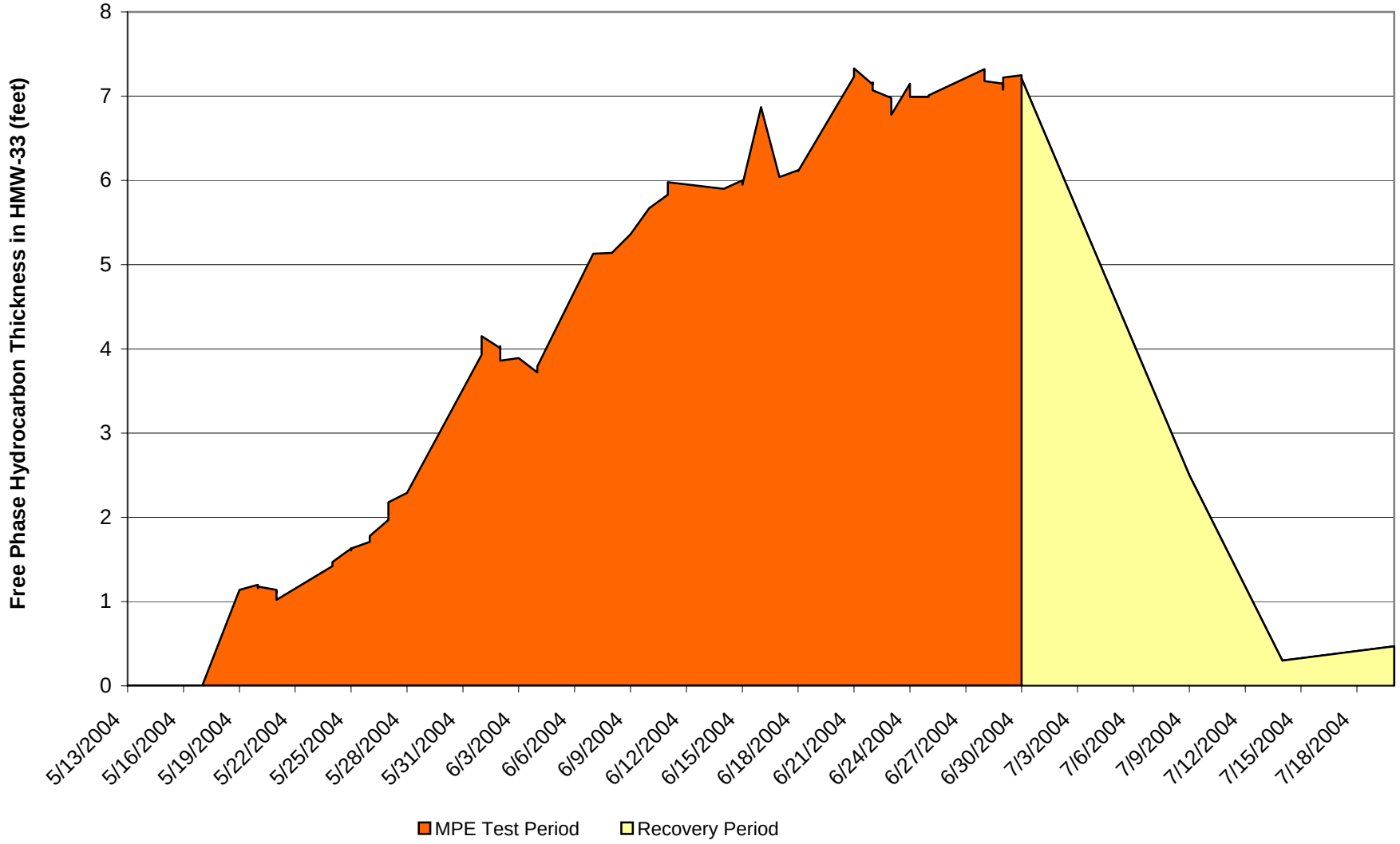


**Figure 5-2: HMW-31 Transducer Water Level Data**

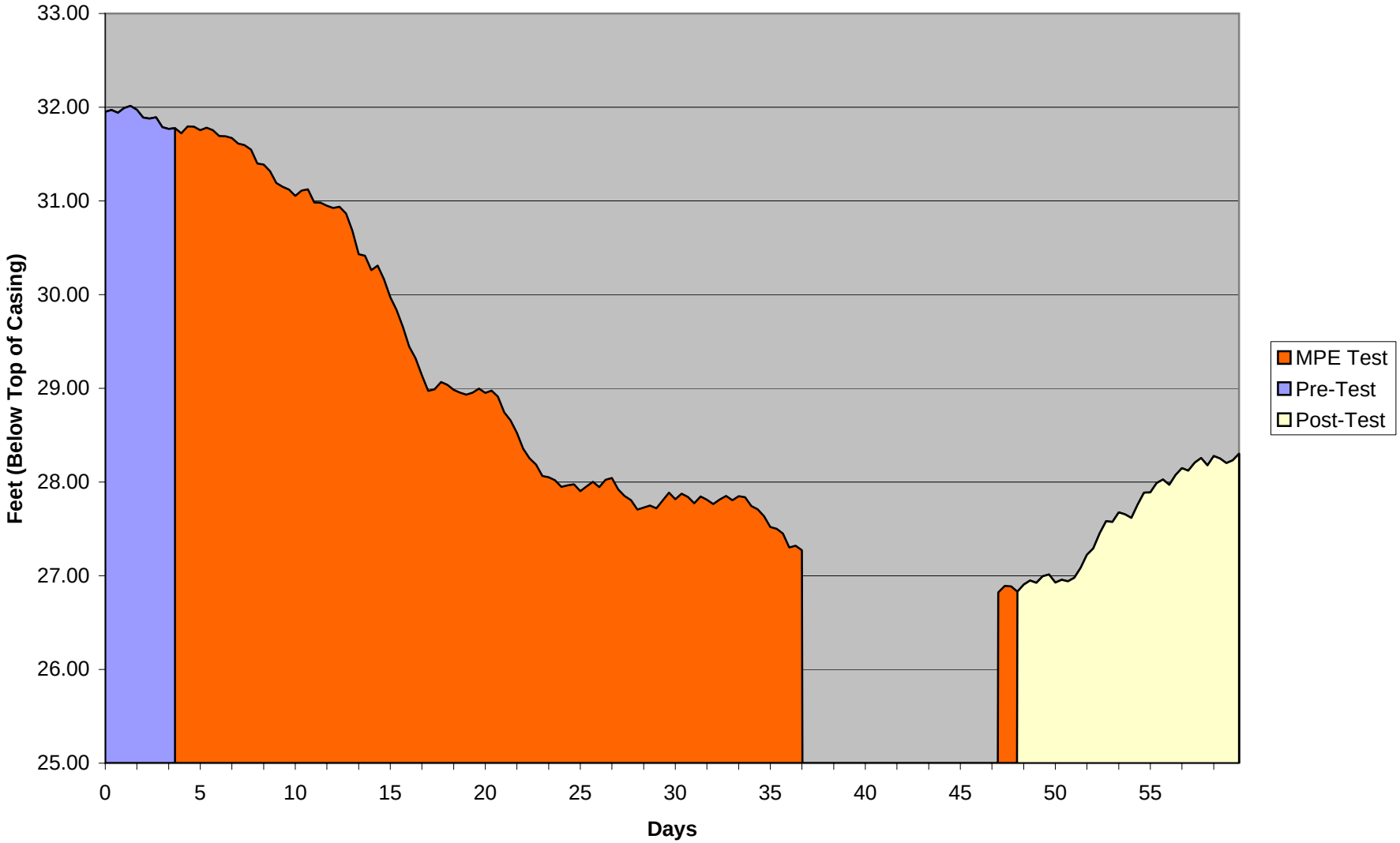
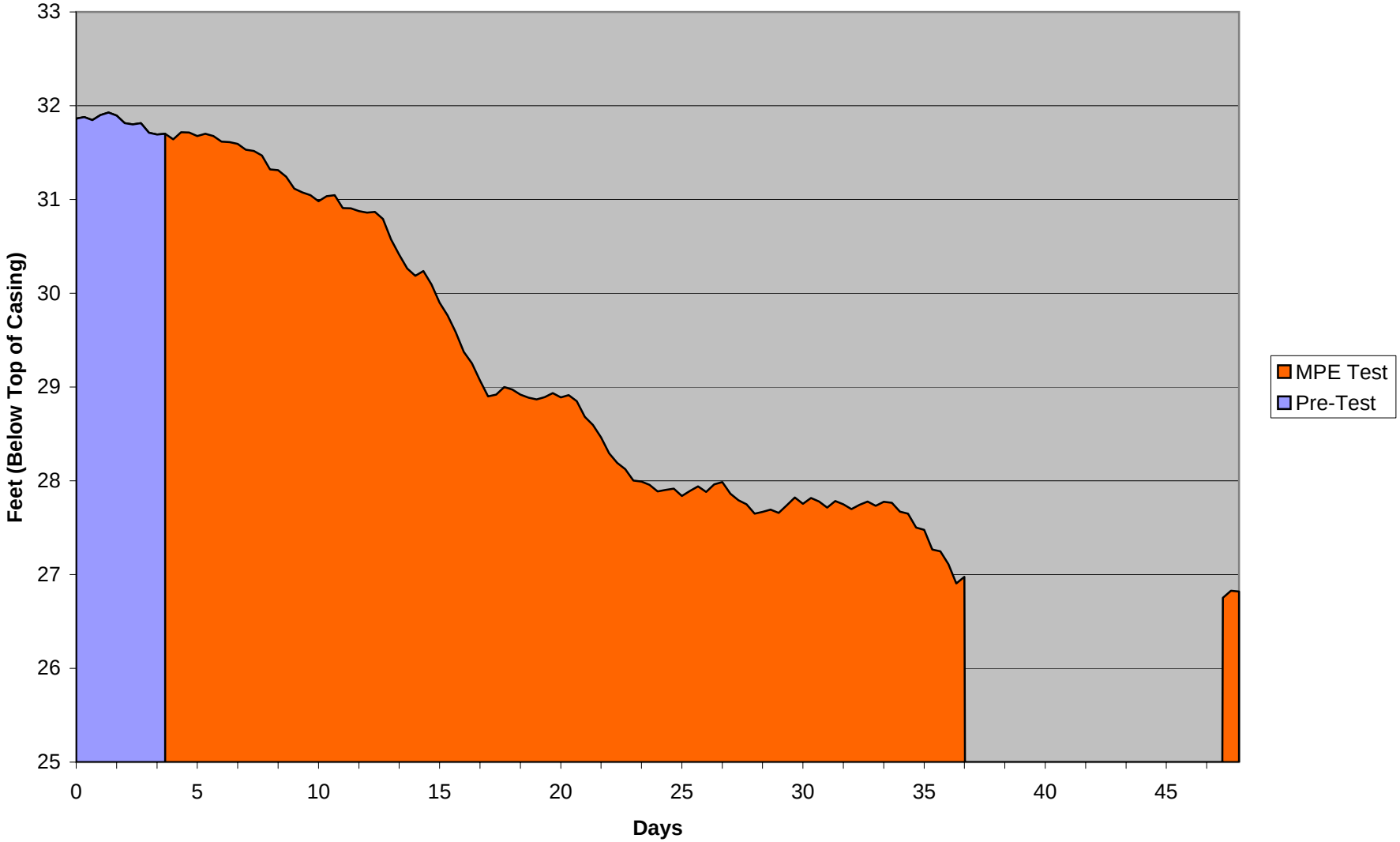
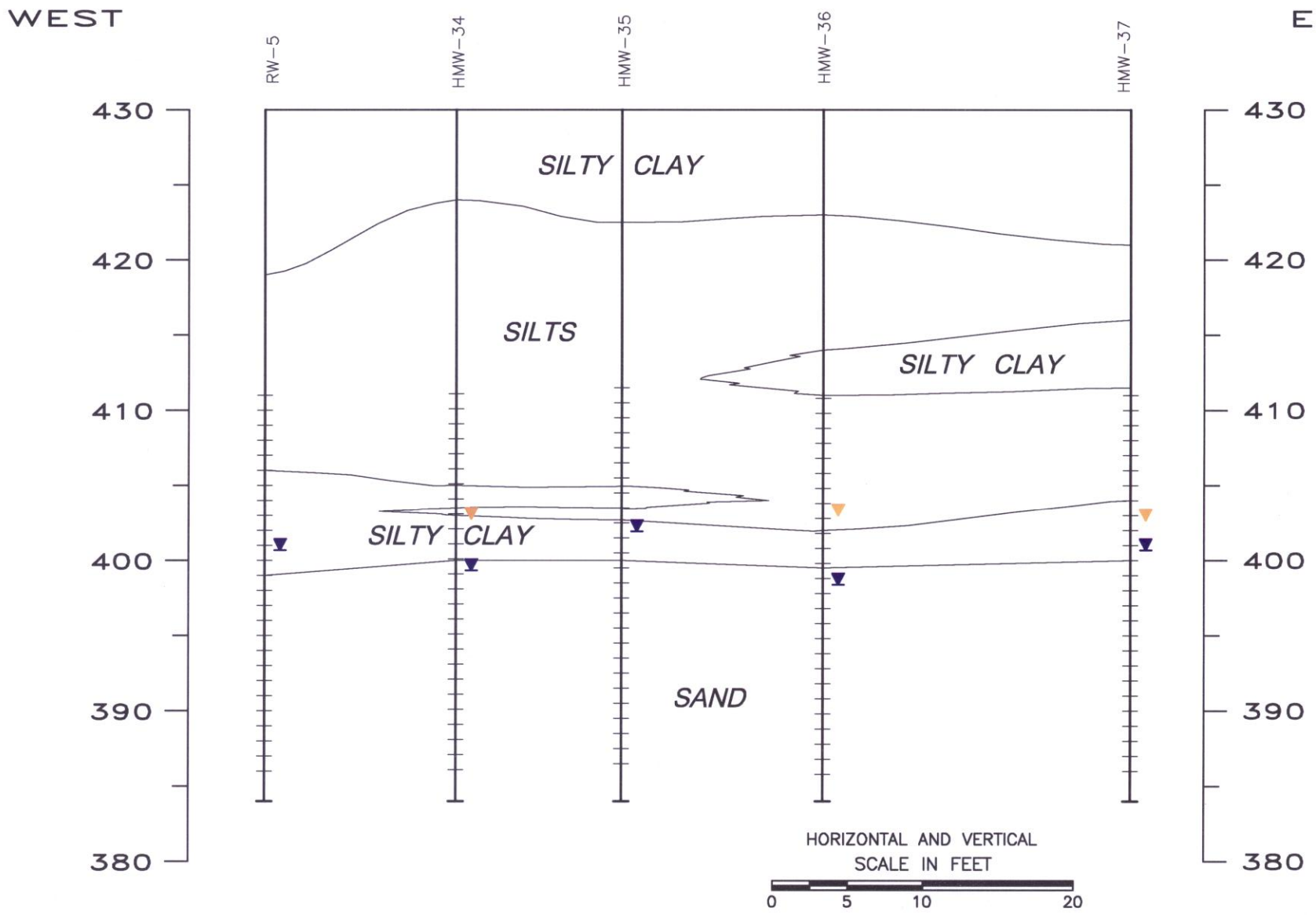


**Figure 5-1: HMW-30 Transducer Water Level Data**






▼ PRODUCT LEVEL MEASUREMENT ON JULY 21, 2004

▼ GROUNDWATER LEVEL MEASUREMENT ON JULY 21, 2004

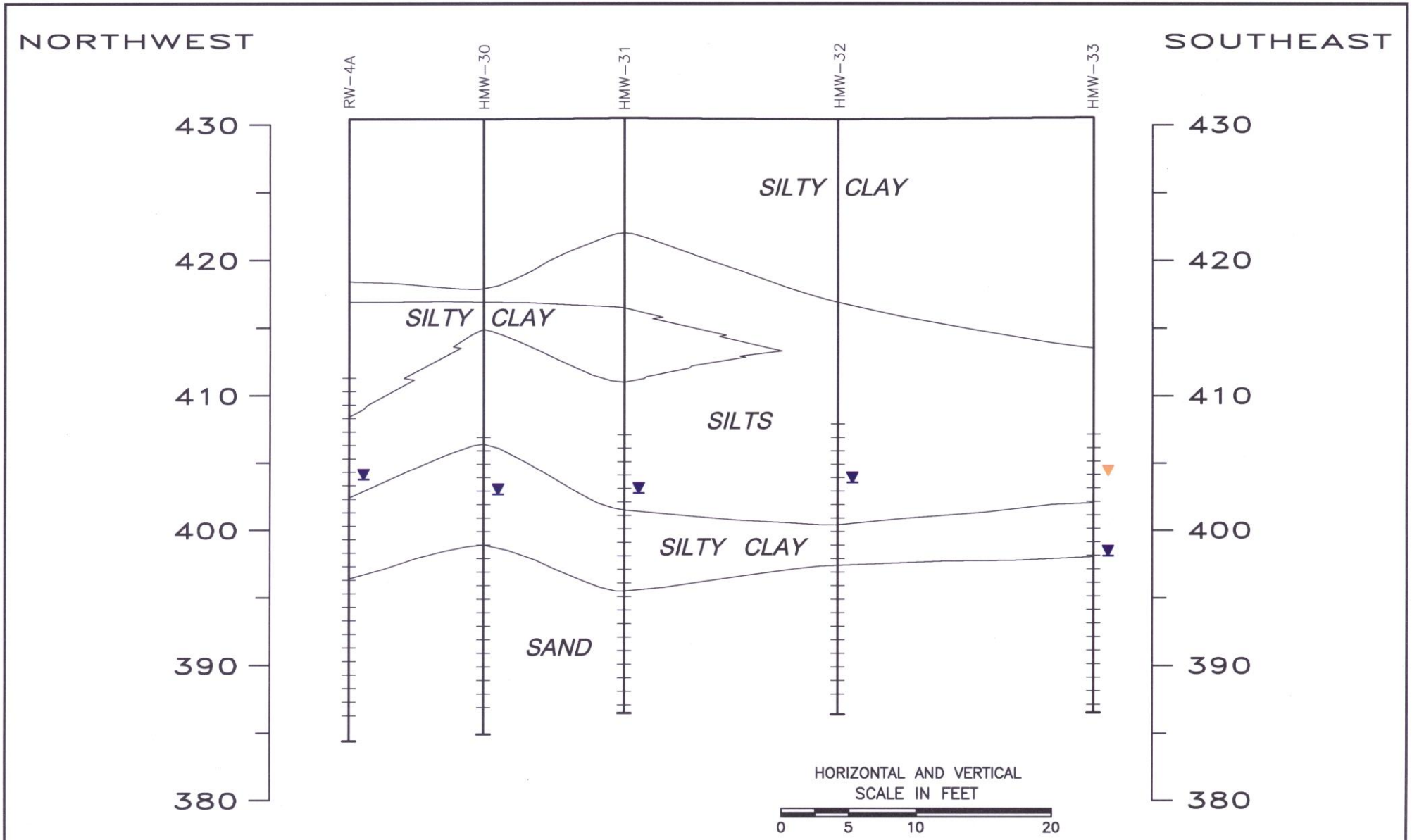
| | |
|---|---|
| CHK BY | |
| DWN BY | BCP |
| DATE | 8-24-04 |
| SCALE | AS SHOWN |
| CAD NO. | 0309513002L |
| PRJ NO. | 15-03095 |

GENERALIZED CROSS SECTION
EAST CHERRY STREET MPE TEST LOCATION

THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton® GROUP SERVICES

FIGURE
2-4



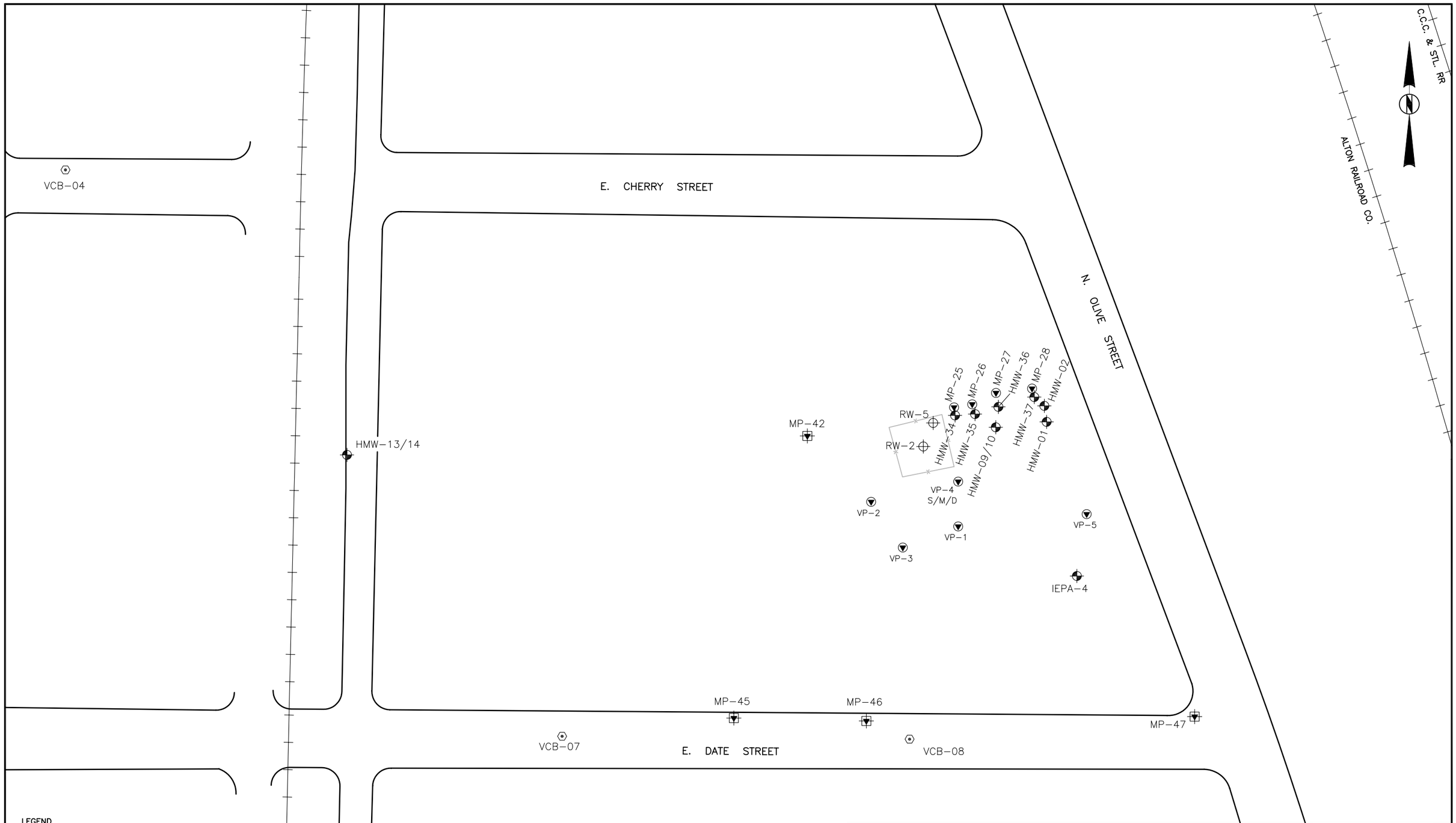

| | |
|---|---|
| CHK BY | |
| DWN BY | BCP |
| DATE | 8-24-04 |
| SCALE | AS SHOWN |
| CAD NO. | 0309513002L |
| PRJ NO. | 15-03095 |

GENERALIZED CROSS SECTION
EAST BIRCH STREET MPE TEST LOCATION

THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
2-3




| | |
|---|---|
| CHECK BY | |
| DRAWN BY | BCP |
| DATE | 8-13-04 |
| SCALE | AS SHOWN |
| CAD NO. | 0309511001B |
| PRJ NO. | 15-03095.11 |

VILLAGE OF HARTFORD
VAPOR MONITORING PROBES AND
MONITORING WELL LOCATIONS

THE HARTFORD WORK GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
2-2

W. BIRCH STREET

E. BIRCH STREET

RW-4A RW-3 MP-9S MP-9D MP-8S MP-8D MP-7S MP-7D MP-5S MP-5D MP-6S MP-6D VCB-01

HMW-30 HMW-07 HMW-08 HMW-31 HMW-32 HMW-33 HMW-21/22

SEE DETAIL "A"

HB-31

STATE ROUTE 3

VCB-02 W. CHERRY STREET VCB-03 VCB-04

E. CHERRY STREET

HMW-18

HMW-13/14

RW-5 RW-2 MP-25 MP-26 MP-27 MP-28 HMW-36 HMW-02 HMW-01 HMW-37 HMW-09/10 HMW-35 HMW-34

IEPA-4

MP-12S MP-12D MP-11S MP-11D

VCB-05 W. DATE STREET MP-10D MP-10S VCB-06

VCB-07 E. DATE STREET VCB-08

N. DELMAR AVENUE

N. OLIVE STREET

ALTON RAILROAD CO.

C.C.C.I. & ST.L. RR.

HMW-19

W. ELM STREET

HB-37 VCB-11

VCB-09 E. ELM STREET VCB-10

OLD ST. LOUIS AND ALTON ROAD

N. MARKET STREET

HMW-20

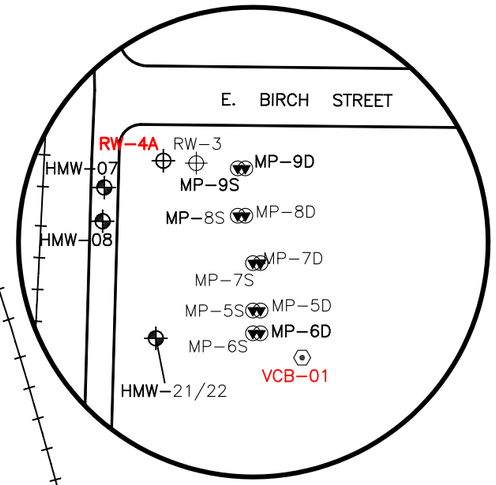
RW-1

HB-07

W. FOREST STREET

MP-16D MP-15D MP-14D MP-13D VCB-12 E. FOREST STREET

MP-16S MP-15S MP-14S MP-13S




## DETAIL "A"

SCALE: 1" = 80'

LEGEND

- SOIL VAPOR MONITORING PROBE (MP)
- MONITORING WELL (HMW)
- MONITORING WELL (HB)
- VAPOR CONTROL BORING (VCB)
- RECOVERY WELL (RW)
- VAPOR CONTROL LINES

NOTE:

SOIL VAPOR MONITORING PROBES (MP) INSTALLED BY CLAYTON ON JULY 23-25, 2003. REMAINING WELLS AND BORINGS INSTALLED BY OTHERS.

SCALE IN FEET

0 75 150 300

| | |
|---|---|
| CHECK BY | |
| DRAWN BY | BCP |
| DATE | 8-13-04 |
| SCALE | AS SHOWN |
| CAD NO. | 0309511001C |
| PRJ NO. | 15-03095.11 |

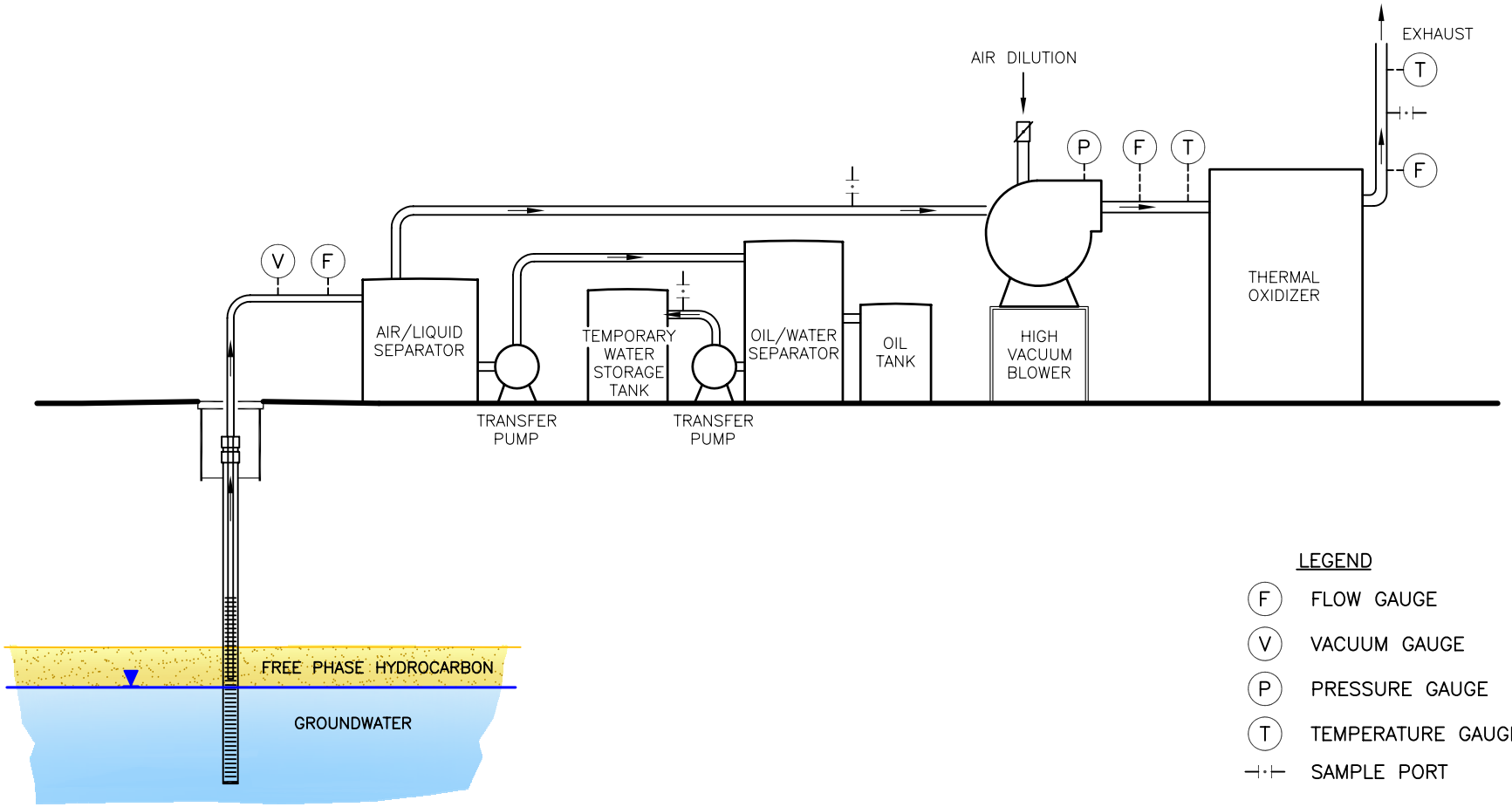
VILLAGE OF HARTFORD
VACUUM MONITORING PROBES
AND MONITORING WELL LOCATIONS

THE HARTFORD WORK GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
2-1

# MULTI-PHASE EXTRACTION PILOT TEST PROCESS FLOW SCHEMATIC




LEGEND

- (F) FLOW GAUGE
- (V) VACUUM GAUGE
- (P) PRESSURE GAUGE
- (T) TEMPERATURE GAUGE
- ⊣·⊢ SAMPLE PORT

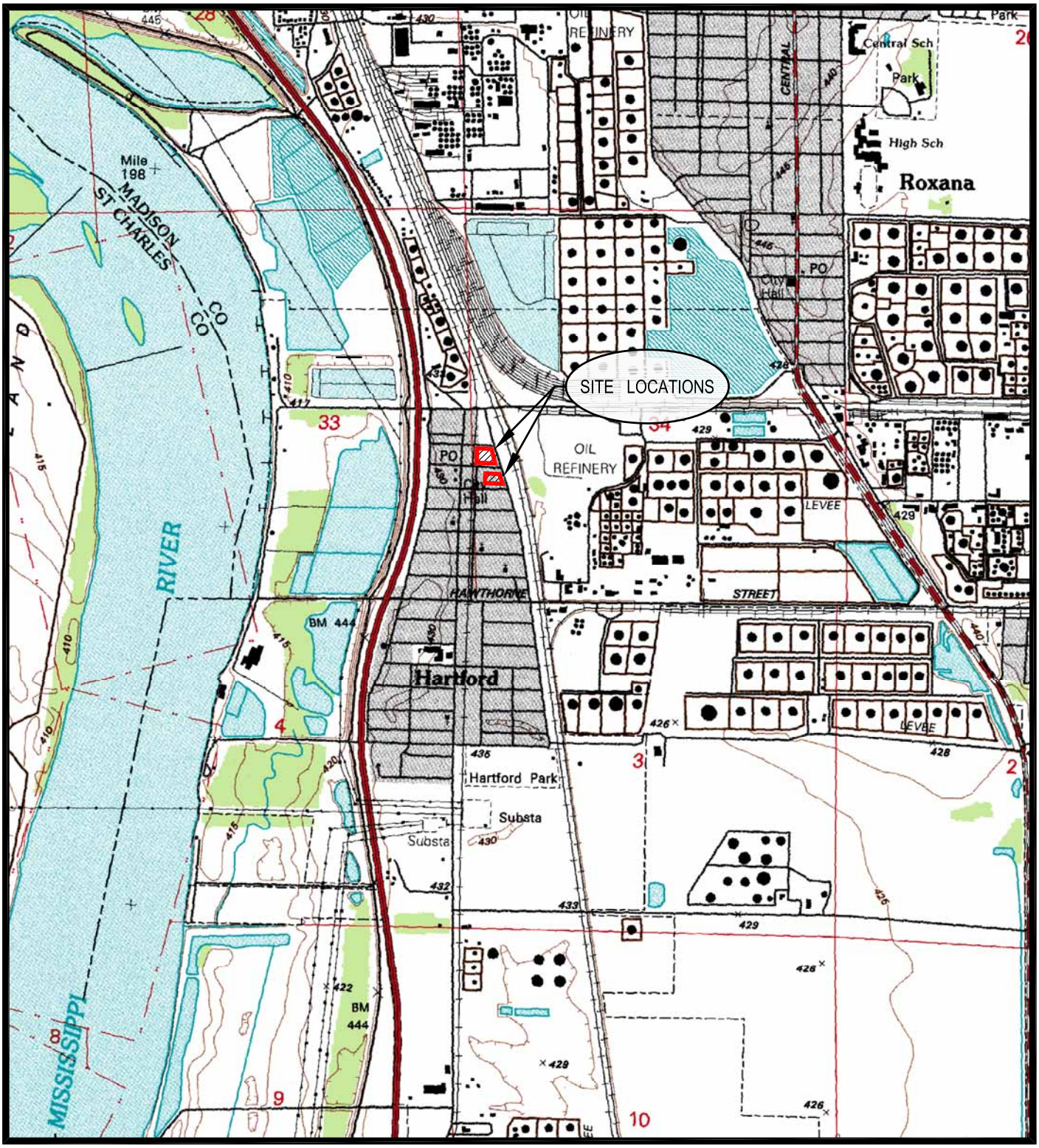
| | |
|---|---|
| CHK BY | JGW |
| DWN BY | BCP |
| DATE | 3-10-04 |
| SCALE | AS SHOWN |
| CAD NO. | 0309512001E |
| PRJ NO. | 15-03094. |

MULTI-PHASE EXTRACTION PILOT TEST
PROCESS FLOW SCHEMATIC

THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

Clayton GROUP SERVICES

FIGURE
1-2




Scale 1:24000

0 1/2 1 MILE

1000 0 1000 2000 3000 FEET


QUADRANGLE LOCATION

# FIGURE 1-1

SITE LOCATION MAP

THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

(SOURCE OF MAP IS USGS 7.5 MINUTE QUADRANGLE MAP, WOOD RIVER, ILL.-MO., rev.1994)

CAD NO. 0309510d.dwg

# TABLE 5-3
## Summary of Air Analytical Results
### *MPE Pilot Test*

**The Hartford Working Group / Hartford, Illinois**

| Date Sampled | Sample ID | Well Location | TPH ppmV | Methane ppmV |
|---|---|---|---|---|
| 06/02/04 | Effluent #1 | RW-3 | 21 | NA |
| 06/07/04 | Exhaust #2 | RW-3 | 42 | 25 |
| 06/17/04 | Exhaust #3 | RW-4A | 250 | 47 |
| 06/23/04 | Exhaust #4 | RW-4A | 430 | 46 |
| 07/15/04 | Exhaust #5 | RW-5 | 160 | 20 |
| 07/23/04 | Exhaust #6 | RW-5 | 40 | 15 |
| 07/29/04 | Exhaust #7 | RW-5 | 53 | 16 |

**NOTES:**

TPH = Total Petroleum Hydrocarbons as Gasoline
ppmV = parts per million - Volume
NA = Not Analyzed

# TABLE 5-2
## Summary of Operational Parameters
### *MPE Test Location - Cherry Street (RW-5)*

**The Hartford Working Group / Hartford, Illinois**

| Date | Wellhead Vacuum (in. WC) | Wellhead Flow Rate (scfm) | Vacuum Response (in. WC) | | | |
|---|---|---|---|---|---|---|
| | | | MP-25 | MP-26 | MP-27 | MP-28 |
| 7/13/04 (pre-test) | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7/14/2004 | 53.20 | 10 | 0.03 | 0.03 | 0.00 | 0.00 |
| 7/15/2003 | 66.50 | 5 | 0.13 | 0.13 | 0.01 | 0.00 |
| 7/16/2004 | 66.50 | 5 | 0.12 | 0.15 | 0.02 | 0.00 |
| 7/19/2004 | 126.35 | 5 | 0.04 | 0.05 | 0.00 | 0.00 |
| 7/20/2004 | 126.35 | 10 | 0.02 | 0.04 | 0.00 | 0.00 |
| 7/21/2004 | 152.95 | 5 | 0.01 | 0.03 | 0.00 | 0.00 |
| 7/22/2004 | 152.95 | 5 | 0.03 | 0.04 | 0.00 | 0.00 |
| 7/23/2004 | 152.95 | 5 | 0.03 | 0.05 | 0.00 | 0.00 |
| 7/26/2004 | 152.95 | 2 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7/27/2004 | 159.60 | 8 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7/28/2004 | 246.05 | 12 | 0.00 | 0.02 | 0.00 | 0.00 |
| 7/29/2004 | 246.05 | 12 | 0.00 | 0.03 | 0.00 | 0.00 |

**NOTES:** in. WC = inches water column

# TABLE 5-1
## Summary of Operational Parameters
### *MPE Test Location - Birch Street (RW-3 and RW-4A)*

**The Hartford Working Group / Hartford, Illinois**

| Date | Well Location | Wellhead Vacuum (in. WC) | Wellhead Flow Rate (scfm) | Vacuum Response (in. WC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MP-5D | MP-5S | MP-6D | MP-6S | MP-7D | MP-7S | MP-8D | MP-8S | MP-9D | MP-9S |
| 5/17/2004 | RW-3 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5/18/2004 | RW-3 | 113.05 | 25 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 5/19/2004 | RW-3 | 199.50 | 12 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 5/20/2004 | RW-3 | 212.80 | 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5/21/2004 | RW-3 | 219.45 | 17 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 5/24/2004 | RW-3 | 192.85 | 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5/25/2004 | RW-3 | 192.85 | 13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5/26/2004 | RW-3 | 186.20 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5/27/2004 | RW-3 | 93.10 | 20 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 5/28/2004 | RW-3 | 206.15 | 10 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/1/2004 | RW-3 | 199.50 | 20 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/2/2004 | RW-3 | 172.90 | 16 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/3/2004 | RW-3 | 186.20 | 12 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/4/2004 | RW-3 | 192.85 | 10 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/7/2004 | RW-3 | 219.45 | 9 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/11/2004 | RW-4A | 226.10 | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/14/2004 | RW-4A | 232.75 | 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/15/2004 | RW-4A | 172.90 | 30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/16/2004 | RW-4A | 192.85 | 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/17/2004 | RW-4A | 93.10 | 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/18/2004 | RW-4A | 192.85 | 22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/21/2004 | RW-4A | 199.50 | 19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6/22/2004 | RW-4A | 212.80 | 11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# TABLE 5-1
## Summary of Operational Parameters
### *MPE Test Location - Birch Street (RW-3 and RW-4A)*

**The Hartford Working Group / Hartford, Illinois**

| Date | Well Location | Wellhead Vacuum (in. WC) | Wellhead Flow Rate (scfm) | Vacuum Response (in. WC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MP-5D | MP-5S | MP-6D | MP-6S | MP-7D | MP-7S | MP-8D | MP-8S | MP-9D | MP-9S |
| 6/23/2004 | RW-4A | 226.10 | 5 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/24/2004 | RW-4A | 212.80 | 9 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/25/2004 | RW-4A | 186.20 | 9 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/28/2004 | RW-4A | 226.10 | 9 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/29/2004 | RW-4A | 192.85 | 11 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 6/30/2004 | RW-4A | 212.80 | 11 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |

**NOTES:** in. WC = inches water column
NM = Not measured

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

P.O. BOX 19506, SPRINGFIELD, ILLINOIS 62794-9506

RENEE CIPRIANO, DIRECTOR

217/782-2113

JOINT CONSTRUCTION AND OPERATING PERMIT

PERMITTEE

Hartford Working Group
Attn: Monte Nienkerk
3140 Finley Road
Downers Grove, Illinois 60515

Application No.: 04040042
Applicant's Designation: MPE TEST
Subject: Multi-Phase Extraction Pilot Test
Date Issued: April 27, 2004
Location: SE Corner East Birch & North Market Street, Hartford

I.D. No.: 119050AAS
Date Received: April 14, 2004
Operating Permit Expiration Date: July 31, 2004

Permit is hereby granted to the above-designated Permittee to CONSTRUCT and OPERATE emission source(s) and/or air pollution control equipment consisting of a multi-phase extraction pilot test process including an air/liquid separator, two transfer pumps, temporary water storage tank, oil/water separator, oil tank, a high vacuum blower and an electric catalytic oxidizer as described in the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

1. Operation of the emission source(s) included in this permit shall not begin until all associated air pollution control equipment has been constructed and is operational.

2. The air/liquid separator shall be controlled by a catalytic oxidizer that reduces volatile organic material (VOM) in the exhaust by at least 99 percent.

3a. Emissions of volatile organic material from the multi-phase extraction pilot test process shall not exceed 60 lb/day.

b. Compliance with the annual limits shall be determined from a running total of 12 months of data.

4a. The owner or operator shall use Illinois EPA and USEPA approved continuous monitoring equipment which shall be installed, calibrated, maintained, and operated according to vendor specifications at all times the catalytic oxidizer is in use.

b. The continuous monitoring equipment must monitor the temperature rise across each catalytic afterburner bed or VOM concentration of exhaust.

5a. The Permittee shall maintain the following operating records for the pilot test process:

i. Pumping speed of the pumping vacuum (acfm);

ii. Measurements of VOM in the effluent stream from the process (prior to the oxidizer).

b. The Permittee shall maintain a record of the VOM emissions from the multi-phase extraction pilot test process with supporting calculations and documentation.

6. The Permittee shall notify the Illinois EPA upon termination of the multi-phase extraction pilot test.

7. If operation of the pilot process is extended, the Permittee may have to submit an application for a CAAPP permit. The determination whether a CAAPP permit is needed will require a demonstration from the Permittee whether the source at which the process is located is a major source for purposes of CAAPP.

If you have any questions on this, please call Jason Schnepp at 217/782-2113.

Donald E Sutton

Donald E. Sutton, P.E.
Manager, Permit Section
Division of Air Pollution Control

DES:JMS:psj

cc: Region 3

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
P. O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

# STANDARD CONDITIONS FOR CONSTRUCTION/DEVELOPMENT PERMITS ISSUED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

July 1, 1985

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) authorizes the Environmental Protection Agency to impose conditions on permits which it issues.

The following conditions are applicable unless susperseded by special condition(s).

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time.

2. The construction or development covered by this permit shall be done in compliance with applicable provisions of the Illinois Environmental Protection Act and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

4. The permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times:

   a. to enter the permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit,

   b. to have access to and to copy any records required to be kept under the terms and conditions of this permit,

   c. to inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit,

   d. to obtain and remove samples of any discharge or emissions of pollutants, and

   e. to enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

5. The issuance of this permit:

   a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located,

   b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities,

   c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations,

   d. does not take into consideration or attest to the structural stability of any units or parts of the project, and

e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. a. Unless a joint construction/operation permit has been issued, a permit for operation shall be obtained from the Agency before the equipment covered by this permit is placed into operation.

   b. For purposes of shakedown and testing, unless otherwise specified by a special permit condition, the equipment covered under this permit may be operated for a period not to exceed thirty (30) days.

7. The Agency may file a complaint with the Board for modification, suspension or revocation of a permit:

   a. upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed, or

   b. upon finding that any standard or special conditions have been violated, or

   c. upon any violations of the Environmental Protection Act or any regulation effective thereunder as a result of the construction or development authorized by this permit.

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
P.O. BOX 19506
SPRINGFIELD, ILLINOIS 62794-9506

# STANDARD CONDITIONS FOR OPERATING PERMITS

May, 1993

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) grants the Environmental Protection Agency authority to impose conditions on permits which it issues.

The following conditions are applicable unless superseded by special permit conditions(s).

1. The issuance of this permit does not release the Permittee from compliance with state and federal regulations which are part of the Illinois State Implementation Plan, as well as with other applicable statues and regulations of the United States or the State of Illinois or with applicable local laws, ordinances and regulations.

2. The Illinois EPA has issued this permit based upon the information submitted by the Permittee in the permit application. Any misinformation, false statement or misrepresentation in the application shall be ground for revocation under 35 Ill. Adm. Code 201.166.

3. a. The Permittee shall not authorize, cause, direct or allow any modification, as defined in 35 Ill. Adm. Code 201.102, of equipment, operations or practices which are reflected in the permit application as submitted unless a new application or request for revision of the existing permit is filed with the Illinois EPA and unless a new permit or revision of the existing permit(s) is issued for such modification.

   b. This permit only covers emission sources and control equipment while physically present at the indicated plant location(s). Unless the permit specifically provides for equipment relocation, this permit is void for an item of equipment on the day it is removed from the permitted location(s) or if all equipment is removed, notwithstanding the expiration date specified on the permit.

4. The Permittee shall allow any duly authorized agent of the Illinois EPA, upon the presentation of credentials, at reasonable times:

   a. To enter the Permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit;

   b. To have access to and to copy any records required to be kept under the terms and conditions of this permit;

   c. To inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit;

   d. To obtain and remove samples of any discharge or emission of pollutants; and

   e. To enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring or recording any activity, discharge or emission authorized by this permit.

5. The issuance of this permit:

   a. Shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are located;

b. Does not release the Permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the facilities;

c. Does not take into consideration or attest to the structural stability of any unit or part of the project; and

d. In no manner implies or suggests that the Illinois EPA (or its officers, agents, or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. The facilities covered by this permit shall be operated in such a manner that the disposal of air contaminants collected by the equipment shall not cause a violation of the Environmental Protection Act or regulations promulgated thereunder.

7. The Permittee shall maintain all equipment covered under this permit in such a manner that the performance of such equipment shall not cause a violation of the Environmental Protection Act or regulations promulgated thereuner.

8. The Permittee shall maintain a maintenance record on the premises for each item of air pollution control equipment. This records shall be made available to any agent of the Environmental Protection Agency at any time during normal working hours and/or operating hours. As a minimum, this record shall show the dates of performance and nature of preventative maintenance activities.

9. No person shall cause or allow continued operation during malfunction, breakdown or startup of any emission source or related air pollution control equipment if such operation would cause a violation of an applicable emission standard or permit limitation. Should a malfunction, breakdown or startup occur which results in emissions in excess of any applicable standard or permit limitation, the Permittee shall:

   a. Immediately report the incident to the Illinois EPA's Regional Field Operations Section Office by telephone, telegraph, or other method as constitutes the fastest available alternative, and shall comply with all reasonable directives of the Illinois EPA with respect to the incident;

   b. Maintain the following records for a period of no less than two (2) years:

      i. Date and duration of malfunction, breakdown, or startup,

      ii. Full and detailed explanation of the cause,

      iii. Contaminants emitted and an estimate of quantity of emissions,

      iv. Measures taken to minimize the amount of emissions during the malfunction, breakdown or startup, and

      v. Measures taken to reduce future occurrences and frequency of incidents.

10. If the permit application contains a compliance program and project completion schedule, the Permittee shall submit a project completion status report within thirty (30) days of any date specified in the compliance program and project completion schedule or at six month intervals, whichever is more frequent.

11. The Permittee shall submit an Annual Emission Report as required by 35 Ill. Adm. Code 201.302 and 35 Ill. Adm. Code Part 254.

# Directory
# Environmental Protection Agency
# Bureau of Air

May 22, 2003

*For assistance in preparing a permit application, contact the Permit Section:*

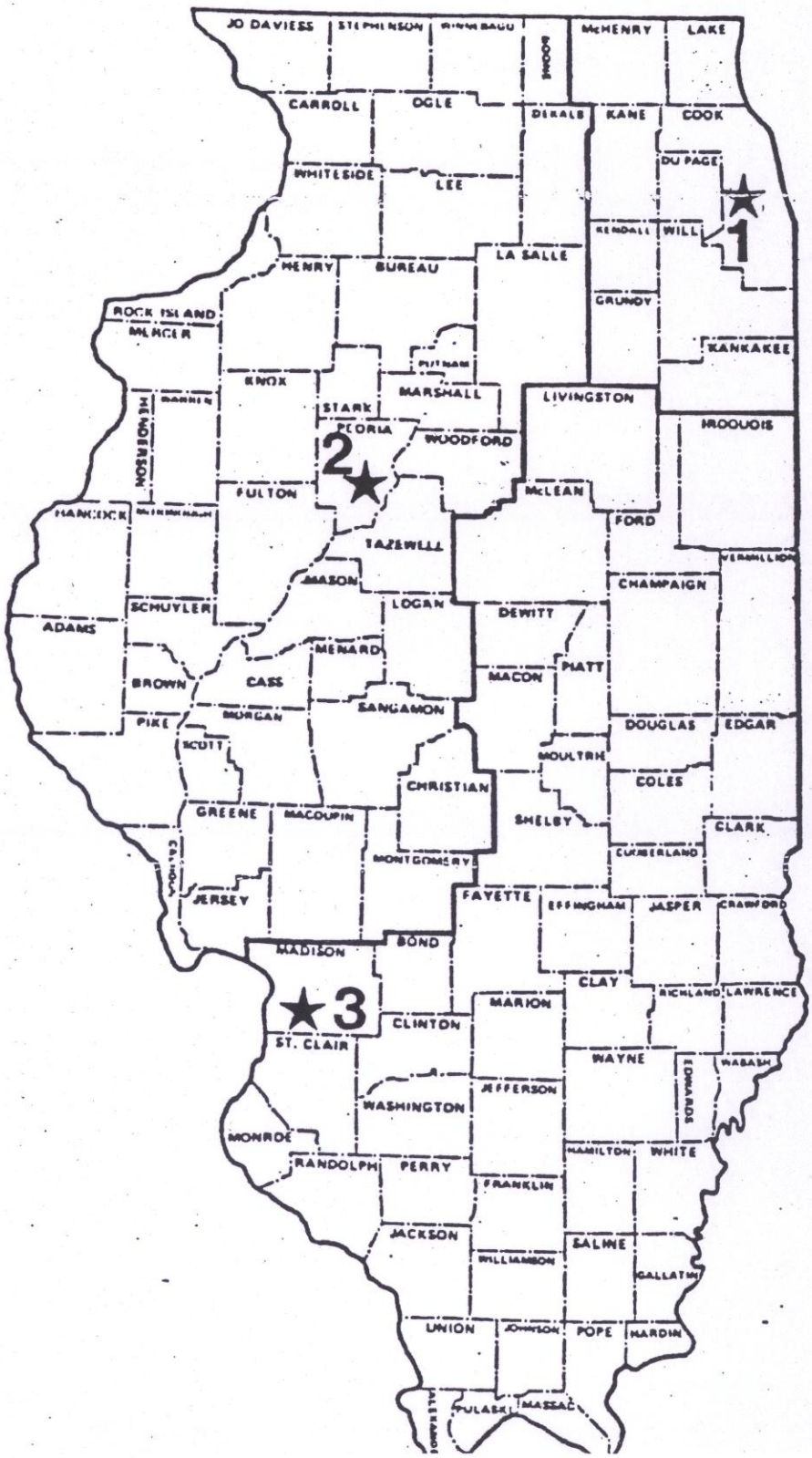
Illinois EPA
Division of Air Pollution Control
Permit Section
1021 N. Grand Ave E.
P.O. Box 19506
Springfield, Illinois 62794-9506
217/782-2113

*Or contact a regional office of the Field Operations Section. The regional offices and their areas of responsibility are shown on the map. The addresses and telephone numbers of the regional offices are as follows:*

Illinois EPA
Region 1
Bureau of Air, FOS
9511 West Harrison
Des Plaines, Illinois 60016
847/294-4000

Illinois EPA
Region 2
5415 North Univiversity
Peoria, Illinois 61614
309/693-5461

Illinois EPA
Region 3
2009 Mall Street
Collinsville, Illinois 62234
618/346-5120



Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: RW-4 | WELL NO: RW-4 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: 8 feet south of RW-3 | | | COORDINATES: 791171.80 N, 2317089.38 E |
| DRILLING CO: Phillips Environmental Services | | DRILLER: J. Bignall | LOGGED BY: J. Campbell |
| DRILLING EQUIP: Hollow Stem Auger | | SCREEN INTERVAL: 23.4' to 43.4' bgs | CHECKED BY: MMW |
| STATIC WATER LEVEL: NA | | SCREEN MTL/SLOT: PVC/0.020" | START DATE: 3/15/04 |
| BOREHOLE DIA: 10.25" | | STICKUP: Flushmount | START TIME (hours): 1330 |
| TOP of CASING ELEVATION: 429.65' MSL | | G.S. ELEVATION: 430.38' MSL | FINISH DATE: 3/18/04 |
| RISER DIA/MTL/LGTH: 4"/PVC/22.7' | | DEV. METHODS: NA | FINISH TIME (hours): 920 |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')** Gravel, light gray, moist | | | 1 | 1/2 | -- | M | -- | 161 | 297 | |
| 2 | **CLAYEY SILT (0.5'-4.0') ML** Gray, moist, trace organics, cohesive, soft, low plasticity, very strong odor | | | 2 | 1.5/2 | SS | M | -- | 1201 | 1217 | |
| 4 | **SILTY CLAY (4.0'-12.0') CL** Gray, moist, cohesive, stiff, medium to high plasticity, slight odor | | | 3 | 2/2 | SS | M | -- | 9.7 | 32 | |
| 6 / 2 | | | | 4 | 2/2 | SS | M | -- | 1.8 | 14.9 | |
| 8 | Some fine sand at 8.0' | | | 5 | 1.5/2 | SS | M | -- | 1.2 | 44.3 | |
| 10 | | | | 6 | 2/2 | SS | M | -- | 195 | 139 | |
| 12 / 4 | **SILTY SAND (12.0'-13.0') SM** Gray, very moist, fine grained, very soft, very strong odor | | | 7 | 2/2 | SS | M | -- | 92.7 | 1092 | |
| 14 | **SILT (13.0'-13.5') ML** Dark gray, wet, cohesive, soft, petroleumsheen | | | 8 | 2/2 | SS | M | -- | 1330 | 411 | |
| 16 | **SILTY CLAY (13.5'-22.0') CL** Gray, moist, brown mottles, cohesive, stiff, medium plasticity | | | 9 | 2/2 | SS | M | -- | 82.1 | 273 | |
| 18 | Very soft at 16.0' | | | 10 | 1.5/2 | SS | M | -- | 423 | 413 | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: RW-4 | WELL NO: RW-4 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 11 | 2/2 | SS | M | -- | 1304 | 1207 | |
| 22 | **SANDY SILT (22.0'-23.5') ML** Gray, wet, fine grained, cohesive, very soft, strong odors, petroleum sheen | | | 12 | 2/2 | SS | W | -- | 580 | 121 | |
| 24 | **CLAYEY SILT (23.5'-24.5') ML** Gray, moist, cohesive, low plasticity, some odor | | | | | | | | | | |
| | **SILTY SAND (24.5'-28.0') SM** Gray, moist, fine grained, well sorted, cohesive, no plasticity, strong odor | | | 13 | 1.5/2 | SS | M | -- | 141 | 450 | |
| 26 | 8 | | | 14 | 1.5/2 | SS | M | -- | 63.9 | 173 | |
| 28 | **SILTY CLAY (28.0'-34.0') CL** Gray, moist, cohesive, stiff, medium plasticity | | | 15 | 1.5/2 | SS | M | -- | 86.3 | 86.2 | |
| 30 | | | | 16 | 1.5/2 | SS | M | -- | 132 | 701 | |
| 32 | 10 Wood at 33.5' Very soft and wet at 34.0' | | | 17 | 1.5/2 | SS | VM | -- | 778 | 341 | |
| 34 | **SAND (34.0'-40.0') SP** Gray, wet, fine to medium grained, well sorted, loose, strong odor | | | 18 | 0.5/2 | SS | W | -- | -- | -- | |
| 36 | | | | 19 | 0.5/2 | SS | W | -- | 1770 | 402 | |
| 38 | | | | 20 | 0.5/2 | SS | -- | -- | 1898 | 505 | |
| | 12 | | | | | | | | | | |
| 40 | | | | | | | | | | | |

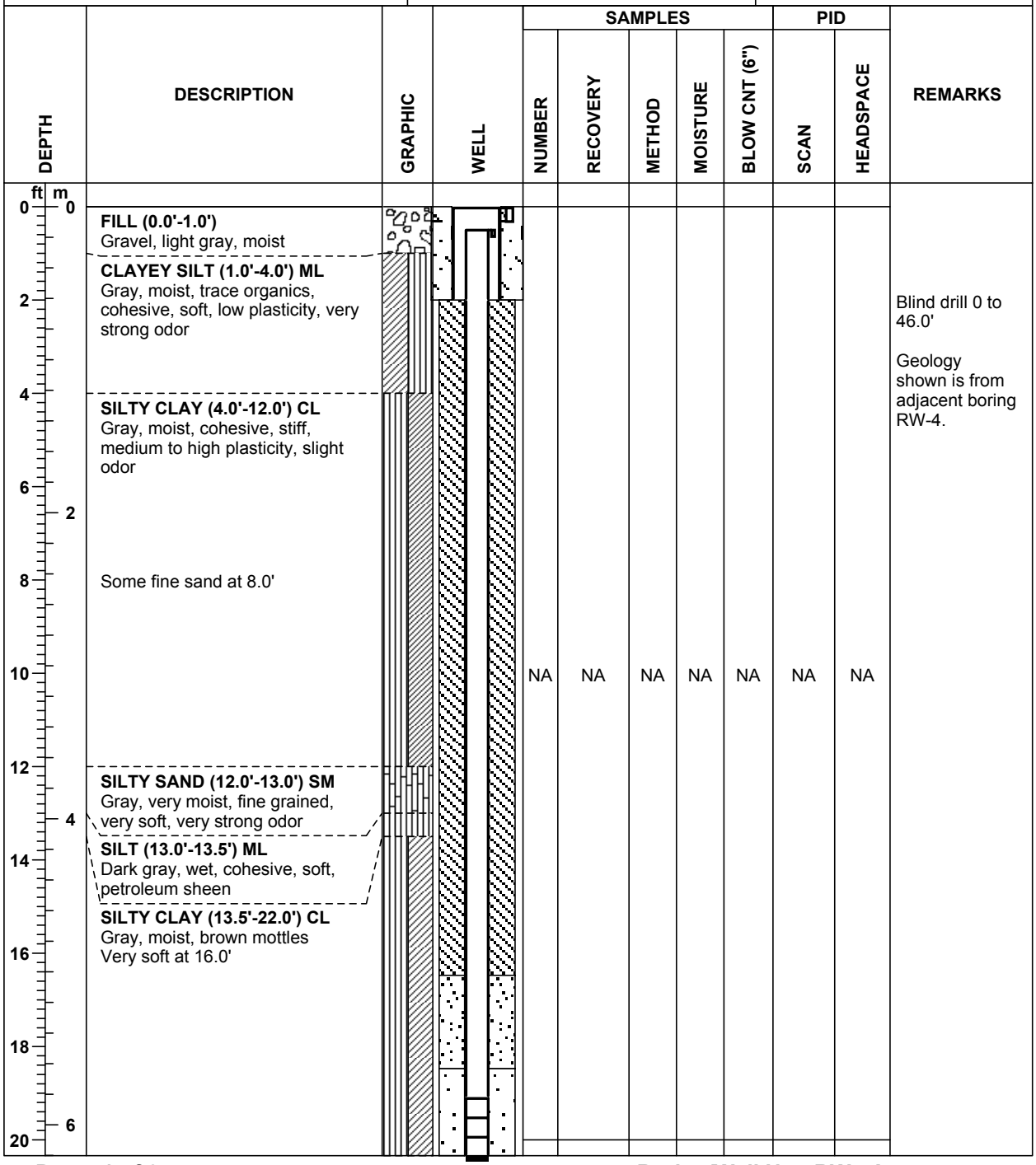
Clayton GROUP SERVICES

| BORING NO: RW-4 | WELL NO: RW-4 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES | | | | | PID | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | SCAN | HEADSPACE | |
| 42 | **NO RECOVERY (40.0'-44.0')** | | | 21 | 0/2 | SS | -- | -- | -- | -- | |
| | | | | 22 | 0/2 | SS | -- | -- | -- | -- | |
| 44 | **SAND (44.0'-46.0') SP** Gray, wet, fine to medium grained, loose, well sorted, strong odor | | | 23 | 1.5/2 | SS | W | -- | 261 | 808 | |
| 46 (14) | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 (16) | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 (18) | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: RW-4A** | **WELL NO: RW-4A** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: SEC of Market St. and Birch St., Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 19.1' to 44.1' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 27.4 ft BGS** | **SCREEN MTL/SLOT: PVC/0.020"** | | **START DATE: 06/08/04** |
| **BOREHOLE DIA: 12"** | **STICKUP:** | | **START TIME (hours): 0700** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/08/04** |
| **RISER DIA/MTL/LGTH: 4"/PVC/19.1'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1745** |






**Boring/Well No.: RW-4A**

Clayton GROUP SERVICES

| BORING NO: RW-4A | WELL NO: RW-4A | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES: NUMBER | SAMPLES: RECOVERY | SAMPLES: METHOD | SAMPLES: MOISTURE | SAMPLES: BLOW CNT (6") | PID: SCAN | PID: HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | **SANDY SILT (22.0'-23.5') ML**<br>Gray, wet, fine grained, cohesive, very soft, strong odor, petroleum sheen | | | | | | | | | | Blind drill 0 to 46.0'<br><br>Geology shown is from adjacent boring RW-4. |
| 24 | **CLAYEY SILT (23.5'-24.5') ML**<br>Gray, moist, cohesive, low plasticity, some odor | | | | | | | | | | |
| 26 | **SILTY SAND (24.5'-28.0') SM**<br>Gray, moist, fine grained, well sorted, cohesive, no plasticity, strong odor | | | | | | | | | | |
| 28 | **SILTY CLAY (28.0'-34.0') CL**<br>Gray, moist, cohesive, stiff, medium plasticity | | | | | | | | | | |
| 30 | | | | NA | NA | NA | NA | NA | NA | NA | |
| 32 | Wood at 33.5'<br>Very soft and wet at 34.0' | | | | | | | | | | |
| 34 | **SAND (34.0'-46.0') SP**<br>Gray, wet, fine to medium grained, well sorted, loose, strong odor | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

8 10 12

Clayton GROUP SERVICES

| BORING NO: RW-4A | WELL NO: RW-4A | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES | | | | | PID | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | SCAN | HEADSPACE | |
| 42 | | | | | NA | NA | NA | NA | NA | NA | Blind drill 0 to 46.0'<br><br>Geology shown is from adjacent boring RW-4. |
| 44 | | | | | | | | | | | |
| 46 | 14 | | | | | | | | | | |
| | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | 16 | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 | 18 | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: RW-5** | **WELL NO: RW-5** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 19.0' to 44.0' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 27.1 ft BGS** | **SCREEN MTL/SLOT: PVC/0.020"** | | **START DATE: 06/09/04** |
| **BOREHOLE DIA: 10"** | **STICKUP:** | | **START TIME (hours): 1210** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/09/04** |
| **RISER DIA/MTL/LGTH: 4"/PVC/19.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1510** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')** Gravel, light gray, moist | | | 1 | -- | LB | -- | NA | NA | NA | PID could not calibrate, therefore, no scan or headspace measurements were obtained |
| 2 | **SILTY CLAY (1.0'-11.0') CL** Dark brown, moist, trace coarse sand, soft, cohesive, medium plasticity | | | 2 | 1.5/2.5 | LB | M | NA | NA | NA | |
| 4 | Grades gray, stiff at 3.5' Grades light brown with gray mottles at 4.5' | | | 3 | 3.5/5 | LB | M | NA | NA | NA | |
| 6 / 2 | | | | | | | | | | | |
| 8 | Grades very soft at 9.0' | | | | | | | | | | |
| 10 | | | | 4 | 4.5/5 | LB | M/S | NA | NA | NA | |
| 12 | **SANDY SILT (11.0'-12.0') ML** Light brown, saturated, fine to medium sand, well sorted, strong odor | | | | | | | | | | |
| 4 / 14 | **SILTY CLAY (12.0'-13.0') CL** Brown with gray mottles, moist, trace coarse sand, stiff, medium plasticity | | | | | | | | | | |
| 16 | **SILTY SAND (13.0'-14.0') SM** Light brown, saturated, fine sand, well sorted, strong odor | | | 5 | 5/5 | LB | S/M | NA | NA | NA | |
| | **CLAYEY SILT (14.0'-18.0') ML** Gray, moist, mottled, very soft, high plasticity, strong odor | | | | | | | | | | |
| 18 | **SANDY SILT (18.0'-24.0') ML** Gray, moist, well sorted, fine to medium grained, very strong odor Saturated at 21.0' | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: RW-5 | WELL NO: RW-5 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | | | | 6 | 4/5 | LB | M/S | NA | NA | NA | PID could not calibrate, therefore, no scan or headspace measurements were obtained |
| 24 | **CLAY (24.0'-25.0') CL** Gray, moist, some silt, very high plasticity, very stiff | | | | | | | | | | |
| 26 (8) | **SILT (25.0'-25.5') ML** Gray, saturated, very well sorted, cohesive<br>**CLAY (25.5'-29.0') CL** Gray, moist, some silt, very high plasticity, very stiff | | | 7 | 5/5 | LB | M/S | NA | NA | NA | |
| 28 | | | | | | | | | | | |
| 30 | **SANDY CLAY (29.0'-31.0') CL** Gray, moist, stiff, strong petroleum odor | | | 8 | 3/5 | LB | M/S | NA | NA | NA | |
| 32 (10) | **SAND (31.0'-46.0') SP** Brown-gray, saturated, poorly sorted, fine to medium grained, strong petroleum odor | | | | | | | | | | |
| 34 | | | | 9 | 1/2 | LB | S | - 5 5 7 | NA | NA | |
| 36 | | | | 10 | 1/2 | SS | S | - 9 10 11 | NA | NA | |
| 38 (12) | Grades with coarse sand at 38.0' | | | 11 | 1/2 | SS | S | 5 10 12 13 | NA | NA | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: RW-5 | WELL NO: RW-5 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | 12 | 0.8/2 | SS | S | 3<br>7<br>10<br>11 | NA | NA | PID could not calibrate, therefore, no scan or headspace measurements were obtained |
| 44 | | | | 13 | 1/2 | SS | S | 5<br>8<br>8<br>9 | NA | NA | |
| 46 | 14 | | | 14 | 1/2 | SS | S | 6<br>11<br>15<br>17 | NA | NA | |
| | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | 16 | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 | 18 | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-5D** | **WELL NO: MP-5D** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791100.42N 2317147.05E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 17.35'- 27.35'** | | **CHECKED BY: D. Lamsma** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 0830** |
| **TOP of CASING ELEVATION: 430.09** | **G.S. ELEVATION: 430.34** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/17.35'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 0925** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 2 | **FILL 0.3'-2.8'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 4 | **CLAYEY SILT (ML) 2.8'-4.3'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 6 / 2 | **SILTY CLAY (CL) 4.3'-11.8'** Grey, moist, trace fine to medium sand | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 8 | | | | | 2/2 | HPU | M | -- | 0 | 35.7 | |
| 10 | Grades brown with rust mottles and some fine to medium sand at 9.1 feet | | | | 2/2 | HPU | M | -- | 10.6 | 50.5 | |
| 12 / 4 | **CLAYEY SILT (ML) 11.8'-14.2'** Brown, moist, some fine sand | | | | 1/2 | HPU | M | -- | 10.7 | 51.2 | |
| 14 | **SILTY CLAY (CL) 14.2'-16.4'** Brown, rust mottles, moist, trace fine sand | | | | 2/2 | HPU | M | -- | 15.5 | 11.4 | |
| 16 | **CLAYEY SILT (ML) 16.4'-18.1'** Grey, moist, with fine sand, petroleum-like odor | | | | 2/2 | HPU | M | -- | 25.1 | 30.4 | |
| 18 | **SILTY SAND (SM) 18.1'-24.4'** Grey, moist, fine sand, petroleum-like odor | | | | 2/2 | HPU | M | -- | 32.8 | 100 | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-5D | WELL NO: MP-5D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1/2 | HPU | M | -- | 20.9 | 77.4 | |
| 22 | | | | | 2/2 | HPU | M | -- | 30.1 | 20.9 | |
| 24 | | | | | 2/2 | HPU | S | -- | 21.3 | 76.0 | |
| 26 – 8 | **SAND (SW) 24.4'-27.2'** Grey, saturated, fine to medium sand, some silt | | | | 2/2 | HPU | S | -- | 1.2 | 0 | |
| 28 | **SILTY SAND (SM) 27.2'-32.0'** Grey, saturated, fine sand | | | | 2/2 | HPU | S | -- | 0 | 3.7 | |
| 30 | | | | | 1/2 | HPU | S | -- | 0 | 2.1 | |
| 32 – 10 | End of Boring at 32.0 feet | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 – 12 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-5S** | **WELL NO: MP-5S** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791100.10N 2317144.96E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 5.0'-10.0'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 0950** |
| **TOP of CASING ELEVATION: 429.83** | **G.S. ELEVATION: 430.34** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/5.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1005** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 2/2 | HPU | M | -- | -- | -- | |
| 2 | **FILL 0.3'-2.8'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **CLAYEY SILT (ML) 2.8'-4.3'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | **SILTY CLAY (CL) 4.3'-10.0'** Grey, moist, trace fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | End of Boring at 10.0 feet | | | | | | | | | | |
| 12 / 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |



**Boring/Well No.: MP-5S**

Clayton GROUP SERVICES

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|---|---|---|---|
| BORING NO: MP-6D | WELL NO: MP-6D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
| BORING LOCATION: VCB-1 Vicinity/E. Birch Street | | COORDINATES: 791088.92N 2317148.61E | |
| DRILLING CO: Roberts Environmental Drilling | DRILLER: J. Crank | LOGGED BY: D. Frieling | |
| DRILLING EQUIP: Geo Cat 642B Geoprobe | SCREEN INTERVAL: 17.35'-27.35' | CHECKED BY: KDC | |
| STATIC WATER LEVEL: NA | SCREEN MTL/SLOT: PVC/0.01" | START DATE: 7/23/03 | |
| BOREHOLE DIA: 4" | STICKUP: Flushmount | START TIME (hours): 1035 | |
| TOP of CASING ELEVATION: 430.13 | G.S. ELEVATION: 430.26 | FINISH DATE: 7/23/03 | |
| RISER DIA/MTL/LGTH: 1.0"/PVC/17.35' | DEV. METHODS: NA | FINISH TIME (hours): 1230 | |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.2'** Gravel | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| | **FILL 0.2'-2.6'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | | | | | | | |
| 2 | **CLAYEY SILT (ML) 2.6'-4.1'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 4 | **SILTY CLAY (CL) 4.1'-16.3'** Grey, moist, trace fine to medium sand | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 6 / 2 | | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 8 | Grades brown with rust mottles and some fine sand at 8.2 feet | | | | 2/2 | HPU | M | -- | 4.1 | 9.0 | |
| 10 | | | | | 2/2 | HPU | M | -- | 9.3 | 71.7 | |
| 12 / 4 | | | | | 2/2 | HPU | M | -- | 5.7 | 19.8 | |
| 14 | | | | | 2/2 | HPU | M | -- | 14.1 | 42.8 | |
| 16 | **CLAYEY SILT (ML) 16.3'-17.4'** Brown, moist, trace fine sand | | | | 1/2 | HPU | M | -- | 24.2 | 86.1 | |
| 18 | **SILTY SAND (SM) 17.4'-23.6'** Grey, saturated, fine sand, petroleum-like odor | | | | 1/2 | HPU | S | -- | 17.8 | 74.3 | |
| 20 / 6 | | | | | | | | | | | |



**Boring/Well No.: MP-6D**

Clayton GROUP SERVICES

| BORING NO: MP-6D | WELL NO: MP-6D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grades black with petroleum-like odor from 20.5 to 23.2 feet | | | | 2/2 | HPU | S | -- | 46.5 | 155 | |
| 22 | | | | | 2/2 | HPU | S | -- | 0 | 0.4 | |
| 24 | **CLAYEY SILT (ML) 23.6'-24.2'** Brown, saturated, some fine sand, petroleum-like odor | | | | | | | | | | |
| | **SAND (SW) 24.2'-26.7'** Black, saturated, fine to medium sand, some silt, petroleum-like odor | | | | 2/2 | HPU | S | -- | 122 | 25.4 | |
| 26 | 8 | | | | | | | | | | |
| | **SILTY SAND (SM) 26.7'-28.0'** Brown, saturated, fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | 4.3 | 0 | |
| 28 | End of Boring at 28.0 feet | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| | 10 | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| | 12 | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

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|---|---|---|---|
| **BORING NO: MP-6S** | **WELL NO: MP-6S** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791089.23N 2317146.81E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 5.0'-10.0'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 1240** |
| **TOP of CASING ELEVATION: 430.15** | **G.S. ELEVATION: 430.26** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/5.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1250** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.2'** Gravel | | | | 2/2 | HPU | M | -- | -- | -- | |
| 2 | **FILL 0.2'-2.6'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **CLAYEY SILT (ML) 2.6'-4.1'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | **SILTY CLAY (CL) 4.1'-10.0'** Grey, moist, trace fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | Grades brown with rust mottles and some fine sand at 8.2 feet | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | End of Boring at 10.0 feet | | | | | | | | | | |
| 12 / 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

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|---|---|---|---|
| **BORING NO: MP-7D** | **WELL NO: MP-7D** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791125.49N 2317140.61E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 16.65'-26.65'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 1305** |
| **TOP of CASING ELEVATION: 430.16** | **G.S. ELEVATION: 430.38** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/16.65'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1410** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.2'** Gravel | | | | | | | | | | No PID readings due to dead battery |
| | **FILL 0.2'-2.4'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 1/2 | HPU | M | -- | -- | -- | |
| 2 | **CLAYEY SILT (ML) 2.4'-4.2'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **SILTY CLAY (CL) 4.2'-12.1'** Grey, moist, some fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | Grades brown with rust mottles and some fine sand at 9.1 feet | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | | | | | 2/2 | HPU | M | -- | -- | -- | |
| 12 / 4 | **CLAYEY SILT (ML) 12.1'-14.5'** Brown, moist, some fine sand, petroleum-like odor | | | | 1/2 | HPU | M | -- | -- | -- | |
| 14 | **SILTY CLAY (CL) 14.5'-17.9'** Brown, rust mottles, moist, trace fine sand, petroleum-like odor | | | | 2/2 | HPU | M | -- | -- | -- | |
| 16 | | | | | 2/2 | HPU | M | -- | -- | -- | |
| 18 / 6 | **SILTY SAND (SM) 17.9'-24.4'** Grey, saturated, fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | -- | -- | |
| 20 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-7D | WELL NO: MP-7D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | | | | | 2/2 | HPU | S | -- | -- | -- | |
| | | | | | 2/2 | HPU | S | -- | -- | -- | |
| 24 | | | | | | | | | | | |
| | **SAND (SW) 24.4'-26.8'** Black, saturated, fine to medium sand, some silt | | | | 1/2 | HPU | S | -- | -- | -- | |
| 26 | 8 | | | | | | | | | | |
| | **SILTY SAND (SM) 26.8'-28'** Brown, saturated, fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | -- | -- | |
| 28 | End of Boring at 28.0 feet | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| | 10 | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| | 12 | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

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|---|---|---|---|
| **BORING NO: MP-7S** | **WELL NO: MP-7S** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791125.20N 2317138.83E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 5.0'-10.0'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 1420** |
| **TOP of CASING ELEVATION: 430.17** | **G.S. ELEVATION: 430.38** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/5.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1435** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.2'** Gravel | | | | 1/2 | HPU | M | -- | -- | -- | |
| 2 | **FILL 0.2'-2.4'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **CLAYEY SILT (ML) 2.4'-4.2'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | **SILTY CLAY (CL) 4.2'-10.0'** Grey, moist, some fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | Grades brown with rust mottles and some fine sand at 9.1 feet | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | End of boring at 10.0 feet | | | | | | | | | | |
| 12 / 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-8D** | **WELL NO: MP-8D** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791148.25N 2317127.74E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 17.35'-27.35'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 1450** |
| **TOP of CASING ELEVATION: 430.14** | **G.S. ELEVATION: 430.37** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/17.35'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1555** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 1/2 | HPU | M | -- | -- | 0 | No PID scans due to dead battery |
| 2 | **FILL 0.3'-3.8'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | 0 | |
| 4 | **CLAYEY SILT (ML) 3.8'-4.3'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | 0 | |
| 6 / 2 | **SILTY CLAY (CL) 4.3'-15.4'** Grey, moist, trace fine sand | | | | 2/2 | HPU | M | -- | -- | 41.8 | |
| 8 | Grades brown with rust mottles and some fine sand at 9.3 feet | | | | 2/2 | HPU | M | -- | -- | 62.9 | |
| 10 | | | | | 2/2 | HPU | M | -- | -- | 101 | |
| 12 / 4 | | | | | 1/2 | HPU | M | -- | -- | 43.1 | |
| 14 | | | | | 1/2 | HPU | M | -- | -- | 46.8 | |
| 16 | **CLAYEY SILT (ML) 15.4'-16.0'** Brown, moist, some fine sand, petroleum-like odor | | | | 2/2 | HPU | M | -- | -- | 27.1 | |
| 18 | **SILTY CLAY (CL) 16.0'-18.2'** Brown, rust mottles, moist, trace fine sand, petroleum-like odor | | | | 1/2 | HPU | S | -- | -- | 61.2 | |
| 20 / 6 | **SILTY SAND (SM) 18.2'-26.3'** Grey, saturated, fine sand, petroleum-like odor | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-8D | WELL NO: MP-8D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES | | | | | PID | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | SCAN | HEADSPACE | |
| 22 | | | | | 2/2 | HPU | S | -- | -- | 1110 | |
| | | | | | 1/2 | HPU | S | -- | -- | 1141 | |
| 24 | | | | | 2/2 | HPU | S | -- | -- | 1562 | |
| 26 | | | | | | | | | | | |
| 8 | **CLAYEY SILT (ML) 26.3'-28'**<br>Grey, saturated, with fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | -- | 1411 | |
| 28 | End of Boring at 28.0 feet | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-8S** | **WELL NO: MP-8S** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791147.46N 2317125.98E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 5.0'-10.0'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/23/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 1615** |
| **TOP of CASING ELEVATION: 430.20** | **G.S. ELEVATION: 430.37** | | **FINISH DATE: 7/23/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/5.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1630** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 1/2 | HPU | M | -- | -- | -- | |
| 2 | **FILL 0.3'-3.8'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **CLAYEY SILT (ML) 3.8'-4.3'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | **SILTY CLAY (CL) 4.3'-10.0'** Grey, moist, trace fine sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | Grades brown with rust mottles and some fine sand at 9.3 feet | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | End of boring at 10.0 feet | | | | | | | | | | |
| 12 / 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-9D** | **WELL NO: MP-9D** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791171.77N 2317120.70E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 17.6'-27.6'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/24/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 0720** |
| **TOP of CASING ELEVATION: 430.00** | **G.S. ELEVATION: 430.22** | | **FINISH DATE: 7/24/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/17.6'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 0820** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 2 | **FILL 0.3'-3.2'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 4 | **CLAYEY SILT (ML) 3.2'-3.8'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | 0 | 0 | |
| 6 / 2 | **SILTY CLAY (CL) 3.8'-15.5'** Grey, moist, trace fine sand | | | | 2/2 | HPU | M | -- | 0 | 0.8 | |
| 8 | Grades brown with rust mottles and some fine sand at 9.6 feet | | | | 2/2 | HPU | M | -- | 0 | 10.6 | |
| 10 | Petroleum-like odorstarts at 11.0 feet | | | | 2/2 | HPU | M | -- | 10.6 | 21.3 | |
| 12 / 4 | | | | | 1/2 | HPU | M | -- | 11.8 | 16.2 | |
| 14 | | | | | 2/2 | HPU | M | -- | 11.2 | 31.2 | |
| 16 | **CLAYEY SILT (ML) 15.5'-16.2'** Brown, moist, some fine sand, petroleum-like odor | | | | 1/2 | HPU | M | -- | 7.8 | 61.4 | |
| 18 | **SILTY CLAY (CL) 16.2'-18.1'** Brown, rust mottles, moist, trace fine sand, petroleum-like odor | | | | 2/2 | HPU | M/W | -- | 4.9 | 41.8 | |
| 20 / 6 | **SILTY SAND (SM) 18.1'-20.6'** Grey, saturated, fine sand, petroleum-like odor | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-9D | WELL NO: MP-9D | PROJECT NO: 15-03095.06-002 | PROJECT NAME: Premcor/Hartford, IL |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CLAYEY SILT (ML) 20.6'-21.9'** Grey, saturated, with fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | 47.2 | 86.5 | |
| 22 | **SILTY SAND (SM) 21.9'-27.8'** Grey, saturated, fine sand, petroleum-like odor | | | | 2/2 | HPU | S | -- | 116 | 247 | |
| 24 | | | | | 2/2 | HPU | S | -- | 463 | 1280 | |
| 26 – 8 | | | | | 2/2 | HPU | S | -- | 342 | 1571 | |
| 28 | **SILTY CLAY (CL) 27.8'-28'** Grey, saturated, with fine sand, petroleum-like odor | | | | | | | | | | |
| | End of Boring at 28.0 feet | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 34 – 10 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 40 – 12 | | | | | | | | | | | |

Clayton GROUP SERVICES

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|---|---|---|---|
| **BORING NO: MP-9S** | **WELL NO: MP-9S** | **PROJECT NO: 15-03095.06-002** | **PROJECT NAME: Premcor/Hartford, IL** |
| **BORING LOCATION: VCB-1 Vicinity/E. Birch Street** | | **COORDINATES: 791170.97N 2317119.01E** | |
| **DRILLING CO: Roberts Environmental Drilling** | **DRILLER: J. Crank** | | **LOGGED BY: D. Frieling** |
| **DRILLING EQUIP: Geo Cat 642B Geoprobe** | **SCREEN INTERVAL: 5.0'-10.0'** | | **CHECKED BY: KDC** |
| **STATIC WATER LEVEL: NA** | **SCREEN MTL/SLOT: PVC/0.01"** | | **START DATE: 7/24/03** |
| **BOREHOLE DIA: 4"** | **STICKUP: Flushmount** | | **START TIME (hours): 0655** |
| **TOP of CASING ELEVATION: 430.05** | **G.S. ELEVATION: 430.22** | | **FINISH DATE: 7/24/03** |
| **RISER DIA/MTL/LGTH: 1.0"/PVC/5.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 0705** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL 0.0'-0.3'** Gravel | | | | 2/2 | HPU | M | -- | -- | -- | |
| 2 | **FILL 0.3'-3.2'** Silty clay, moist, dusky, some fine to medium sand, trace roots | | | | 2/2 | HPU | M | -- | -- | -- | |
| 4 | **CLAYEY SILT (ML) 3.2'-3.8'** Brown, moist, with fine to medium sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 6 / 2 | **SILTY CLAY (CL) 3.8'-10.0'** Grey, moist, trace fine sand | | | | 2/2 | HPU | M | -- | -- | -- | |
| 8 | Grades brown with rust mottles and some fine sand at 9.6 feet | | | | 2/2 | HPU | M | -- | -- | -- | |
| 10 | End of Boring at 10.0 feet | | | | | | | | | | |
| 12 / 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 / 6 | | | | | | | | | | | |

| BORING NO: MP-25 | WELL NO: MP-25 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|
| BORING LOCATION: Hartford, Illinois | | COORDINATES: | |
| DRILLING CO: MRK | DRILLER: J. Brown | LOGGED BY: J. Campbell | |
| DRILLING EQUIP: Simco 2800/HSA | SCREEN INTERVAL: 13.8'-28.8' bgs | CHECKED BY: MMW | |
| STATIC WATER LEVEL: 25.8 ft BGS | SCREEN MTL/SLOT: PVC/0.010" | START DATE: 06/14/04 | |
| BOREHOLE DIA: 8" | STICKUP: | START TIME (hours): 1115 | |
| TOP of CASING ELEVATION: | G.S. ELEVATION: | FINISH DATE: 06/14/04 | |
| RISER DIA/MTL/LGTH: 1"/PVC/13.8' | DEV. METHODS: NA | FINISH TIME (hours): 1145 | |

| DEPTH (ft) | DESCRIPTION | GRAPHIC | WELL | SAMPLES: NUMBER | SAMPLES: RECOVERY | SAMPLES: METHOD | SAMPLES: MOISTURE | SAMPLES: BLOW CNT (6") | PID: SCAN | PID: HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **FILL (0.0'-1.0')**<br>Grass underlain by topsoil | | | | | | | | | | Blind drill 0 to 29.0'<br><br>Geology shown is from boring HMW-34. |
| | **SILTY CLAY (1.0'-6.0') CL**<br>Brown, moist, trace organics, high plasticity<br>Grades stiff at 3.0' | | | | | | | | | | |
| 6 | **CLAYEY SILT (6.0'-10.0') ML**<br>Brown, mottled, moist, some fine sand, very soft, cohesive | | | | | | | | | | |
| 10 | **SILT (10.0'-11.0') ML**<br>Brown, wet,some fine sand,cohesive, mottled, well sorted | | | | NA | NA | NA | NA | NA | NA | |
| 12 | **CLAYEY SILT (11.0'-13.5') ML**<br>Bown, moist, very soft, mottled, cohesive | | | | | | | | | | |
| 14 | **SILT (13.5'-14.5') ML**<br>Gray, wet, mottled, some fine sand, well sorted, cohesive | | | | | | | | | | |
| 16 | **CLAYEY SILT (14.5'-18.0') ML**<br>Gray, moist, mottled, soft, very strong odor | | | | | | | | | | |
| 18 | **SILT (18.0'-21.0') ML**<br>Gray, moist, some fine sand, very well sorted, cohesive, very strong odor | | | | | | | | | | |
| 20 | | | | | | | | | | | |

(m: 0, 2, 4, 6)

Clayton GROUP SERVICES

| BORING NO: MP-25 | WELL NO: MP-25 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | **SAND (21.0'-22.0') SP** Gray, saturated, fine grained, some silt, loose, sheen | | | | | | | | | | Blind drill 0 to 29.0' |
| | **CLAYEY SILT (22.0'-25.0') ML** Gray, wet, cohesive, mottled | | | | | | | | | | Geology shown is from boring HMW-34. |
| 24 | | | | | NA | NA | NA | NA | NA | NA | |
| 26 | **CLAY (25.0'-26.5') CL** Gray, moist, very stiff, high plasticity, fat | | | | | | | | | | |
| 8 | **SILT (26.5'-27.0') ML** Gray, wet, soft, cohesive, very well sorted, some fine sand | | | | | | | | | | |
| 28 | **CLAY (27.0'-29.0') CL** Gray, moist, very stiff, high plasticity, fat | | | | | | | | | | |
| 30 | End of Boring at 29.0' | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-26** | **WELL NO: MP-26** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: MRK** | **DRILLER: J. Brown** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: Simco 2800/HSA** | **SCREEN INTERVAL: 13.8'-28.8' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 24.6 ft BGS** | **SCREEN MTL/SLOT: PVC/0.010"** | | **START DATE: 06/14/04** |
| **BOREHOLE DIA: 8"** | **STICKUP:** | | **START TIME (hours): 1330** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/14/04** |
| **RISER DIA/MTL/LGTH: 1"/PVC/13.8'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1445** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES: NUMBER | SAMPLES: RECOVERY | SAMPLES: METHOD | SAMPLES: MOISTURE | SAMPLES: BLOW CNT (6") | PID: SCAN | PID: HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')**<br>Grass underlain by topsoil | | | | | | | | | | Blind drill 0 to 29.0'<br><br>Geology shown is from boring HMW-35. |
| | **SILTY CLAY (1.0'-7.5') CL**<br>Brown, moist, trace organics, soft, medium plasticity, cohesive<br>Grades stiff at 4.5' | | | | | | | | | | |
| 2 / 1 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 6 / 2 | | | | | | | | | | | |
| 8 | **CLAYEY SILT (7.5'-10.0') ML**<br>Light brown, moist, mottled, soft, low plasticity, cohesive | | | | | | | | | | |
| 10 | **SILT (10.0'-11.5') ML**<br>Brown, wet,some clay, very well sorted, cohesive | | | | NA | NA | NA | NA | NA | NA | |
| 12 | **CLAYEY SILT (11.5'-12.5') ML**<br>Gray, wet, low plasticity, cohesive, soft | | | | | | | | | | |
| 4 | **SILT (12.5'-14.5') ML**<br>Gray, saturated, very well sorted, some fine sand, strong odor | | | | | | | | | | |
| 14 | **CLAYEY SILT (14.5'-19.0') ML**<br>Brown, moist, mottled, soft, cohesive, low plasticity, slight odor | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-26 | WELL NO: MP-26 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SILT (19.0'-20.0') ML**<br>Gray, moist, some fine sand, very strong odor | | | | | | | | | | |
| | **CLAYEY SILT (20.0'-21.0') ML**<br>Gray, moist, cohesive, low plasticity, soft | | | | | | | | | | |
| 21 | **SAND (21.0'-22.5') SP**<br>Gray, saturated, fine grained, some silt, loose | | | | | | | | | | Blind drill 0 to 29.0'<br><br>Geology shown is from boring HMW-35. |
| 23 — 7 | **SILTY CLAY (22.5'-27.3') CL**<br>Gray, moist, mottled, stiff, medium plasticity<br><br>3-inch silt seam, saturated at 24.5' | | | | NA | NA | NA | NA | NA | NA | |
| 25 | | | | | | | | | | | |
| | 3-inch silt seam, saturated at 27.0' | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| | **CLAY (27.3'-29.0') CL**<br>Gray, moist, very stiff, high plasticity, fat<br>3-inch sand seam, medium grained, moist at 28.5' | | | | | | | | | | |
| 29 — 9 | End of Boring at 29.0' | | | | | | | | | | |
| 31 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 35 | | | | | | | | | | | |
| 37 — 11 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: MP-27** | **WELL NO: MP-27** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 14.3'-29.3' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 25.6 ft BGS** | **SCREEN MTL/SLOT: PVC/0.010"** | | **START DATE: 06/15/04** |
| **BOREHOLE DIA: 8"** | **STICKUP:** | | **START TIME (hours): 0745** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/15/04** |
| **RISER DIA/MTL/LGTH: 1"/PVC/14.3'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 0945** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES: NUMBER | SAMPLES: RECOVERY | SAMPLES: METHOD | SAMPLES: MOISTURE | SAMPLES: BLOW CNT (6") | PID: SCAN | PID: HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')**<br>Grass underlain by topsoil | | | | | | | | | | Blind drill 0 to 29.5'<br><br>Geology shown is from boring HMW-36. |
| | **SILTY CLAY (1.0'-7.0') CL**<br>Brown, moist, trace coarse sand, trace organics, stiff, high plasticity | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 6 / 2 | | | | | | | | | | | |
| | **CLAYEY SILT (7.0'-9.5') ML**<br>Light brown, moist, mottled,very soft, low plasticity | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 10 | **SANDY SILT (9.5'-12.0') ML**<br>Light brown, moist, mottled, slightly cohesive<br><br>Saturated at 11.5' | | | | NA | NA | NA | NA | NA | NA | |
| 12 | **CLAYEY SILT (12.0'-13.0') ML**<br>Gray, moist, very soft, low plasticity, cohesive | | | | | | | | | | |
| 4 | **SILT (13.0'-16.0') ML**<br>Gray, saturated, slightly cohesive, very strong odor<br><br>Grades clay at 14.0' | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | **SILTY CLAY (16.0'-19.0') CL**<br>Gray with brown mottles, moist, soft, cohesive,medium plasticity | | | | | | | | | | |
| 18 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: MP-27 | WELL NO: MP-27 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **SILT (19.0'-22.5') ML**<br>Gray, moist, trace clay, some fine sand, very soft, cohesive,<br><br>Saturated, very strong odor at 22.0' | | | | | | | | | | Blind drill 0 to 29.5'<br><br>Geology shown is from boring HMW-36. |
| 23 — 7 | **SILTY CLAY (22.5'-29.5') CL**<br>Gray with brown mottles, moist, medium plasticity, soft | | | | NA | NA | NA | NA | NA | NA | |
| 25 | | | | | | | | | | | |
| 27 | Silt seam, saturated at 27.5' | | | | | | | | | | |
| 29 | Grades more clay, stiff, high plasticity at 29.0' | | | | | | | | | | |
| — 9 | End of Boring at 29.5' | | | | | | | | | | |
| 31 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 35 | | | | | | | | | | | |
| — 11 | | | | | | | | | | | |
| 37 | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| BORING NO: MP-28 | WELL NO: MP-28 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: Hartford, Illinois | | COORDINATES: | |
| DRILLING CO: Phillips Environmental Services | DRILLER: J. Bignall | | LOGGED BY: J. Campbell |
| DRILLING EQUIP: CME-75/HSA | SCREEN INTERVAL: 14.3'-29.3' bgs | | CHECKED BY: MMW |
| STATIC WATER LEVEL: 16.9 ft BGS | SCREEN MTL/SLOT: PVC/0.010" | | START DATE: 06/14/04 |
| BOREHOLE DIA: 8" | STICKUP: | | START TIME (hours): 1455 |
| TOP of CASING ELEVATION: | G.S. ELEVATION: | | FINISH DATE: 06/14/04 |
| RISER DIA/MTL/LGTH: 1"/PVC/14.3' | DEV. METHODS: NA | | FINISH TIME (hours): 1645 |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES: NUMBER | SAMPLES: RECOVERY | SAMPLES: METHOD | SAMPLES: MOISTURE | SAMPLES: BLOW CNT (6") | PID: SCAN | PID: HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')**<br>Grass underlain by topsoil | | | | | | | | | | Blind drill 0 to 29.5'<br><br>Geology shown is from boring HMW-37. |
| | **SILTY CLAY (1.0'-9.0') CL**<br>Dark brown, moist, trace organics, low plasticity, soft, cohesive | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| | Grades light brown mottled, soft, high plasticity at 5.5' | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| | **CLAYEY SILT (9.0'-12.5') ML**<br>Light brown, moist, mottled,very soft, low plasticity | | | | NA | NA | NA | NA | NA | NA | |
| 10 | | | | | | | | | | | |
| 12 | | | | | | | | | | | |
| | **SILT (12.5'-14.0') ML**<br>Gray, saturated, very well sorted, trace clay | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| | **SILTY CLAY (14.0'-18.5') CL**<br>Gray, moist, soft, medium plasticity, very strong odor | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |

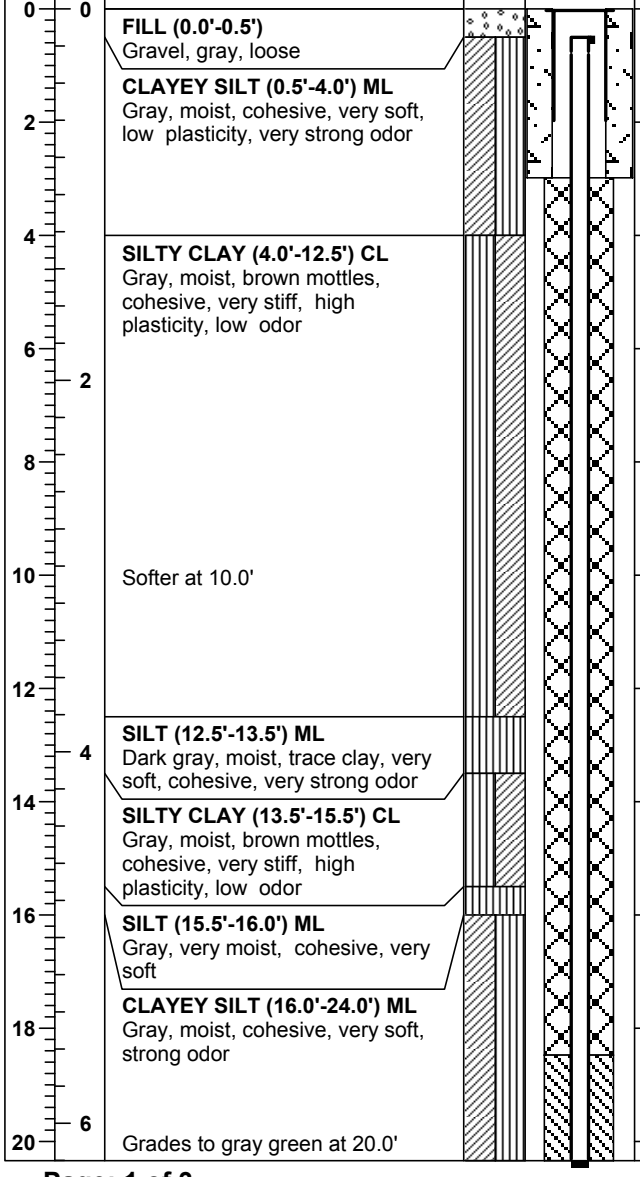
Clayton GROUP SERVICES

| BORING NO: MP-28 | WELL NO: MP-28 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CLAYEY SILT (18.5'-26.0') ML**<br>Gray,wet, very soft, low plasticity | | | | | | | | | | |
| | Saturated silt seam at 22.0' | | | | | | | | | | |
| 21 | Saturated silt seam at 23.5' | | | | | | | | | | |
| 23 — 7 | | | | | NA | NA | NA | NA | NA | NA | Blind drill 0 to 29.5'<br><br>Geology shown is from boring HMW-37. |
| 25 | | | | | | | | | | | |
| | **CLAY (26.0'-29.5') CL**<br>Gray, moist, stiff, high plasticity | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| 29 — 9 | | | | | | | | | | | |
| | End of Boring at 29.5' | | | | | | | | | | |
| 31 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 35 | | | | | | | | | | | |
| 37 — 11 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: HMW-30 | WELL NO: HMW-30 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: 10ft SW of RW-4 | | | COORDINATES: 791163.75N, 2317094.86E |
| DRILLING CO: Phillips Environmental Services | | DRILLER: J. Bignall | LOGGED BY: J. Campbell |
| DRILLING EQUIP: Hollow Stem Auger | | SCREEN INTERVAL: 23.5' to 43.5' bgs | CHECKED BY: MMW |
| STATIC WATER LEVEL: NA | | SCREEN MTL/SLOT: PVC/0.010" | START DATE: 3/16/04 |
| BOREHOLE DIA: 8.25" | | STICKUP: Flushmount | START TIME (hours): 1130 |
| TOP of CASING ELEVATION: 430.07 MSL | | G.S. ELEVATION: 430.38 MSL | FINISH DATE: 3/16/04 |
| RISER DIA/MTL/LGTH: 2"/PVC/23.2' | | DEV. METHODS: Double Whale Pump | FINISH TIME (hours): 1600 |



| DEPTH (ft / m) | DESCRIPTION | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-0.5')** Gravel, gray, loose | 1 | 1.5/2 | SS | M | -- | 1469 | 582 | |
| | **CLAYEY SILT (0.5'-4.0') ML** Gray, moist, cohesive, very soft, low plasticity, very strong odor | 2 | 2/2 | SS | M | -- | 1288 | 917 | |
| 4 | **SILTY CLAY (4.0'-12.5') CL** Gray, moist, brown mottles, cohesive, very stiff, high plasticity, low odor | 3 | 1.5/2 | SS | M | -- | 20.3 | 13.0 | |
| 6 / 2 | | 4 | 2/2 | SS | M | -- | 5.0 | 5.1 | |
| 8 | | 5 | 1.5/2 | SS | M | -- | 4.3 | 37.0 | |
| 10 | Softer at 10.0' | 6 | 2/2 | SS | M | -- | 206 | 122 | |
| 12 / 4 | **SILT (12.5'-13.5') ML** Dark gray, moist, trace clay, very soft, cohesive, very strong odor | 7 | 2/2 | SS | M | -- | 1357 | 411 | |
| 14 | **SILTY CLAY (13.5'-15.5') CL** Gray, moist, brown mottles, cohesive, very stiff, high plasticity, low odor | 8 | 2/2 | SS | M/VM | -- | 1195 | 1219 | |
| 16 | **SILT (15.5'-16.0') ML** Gray, very moist, cohesive, very soft | 9 | 2/2 | SS | M | -- | 1549 | 1114 | |
| 18 | **CLAYEY SILT (16.0'-24.0') ML** Gray, moist, cohesive, very soft, strong odor | 10 | 1/2 | SS | M | -- | 1286 | 950 | |
| 20 / 6 | Grades to gray green at 20.0' | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-30 | WELL NO: HMW-30 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 11 | 1.5/2 | SS | M | -- | 956 | 1089 | |
| 22 | | | | 12 | 1.5/2 | SS | M | -- | 530 | 814 | |
| 24 | **SILTY CLAY (24.0'-31.5') CL**<br>Gray, moist, cohesive, stiff, trace coarse sand | | | 13 | 2/2 | SS | M | -- | 968 | 276 | |
| 26 | 8 | | | 14 | 2/2 | SS | M | -- | 360 | 90.2 | |
| 28 | 3-Inch sand seam, fine grained, moist at 28.0' | | | 15 | 1/2 | SS | M | -- | 33.2 | 88.8 | |
| 30 | Wood at 31.0' | | | 16 | 1.5/2 | SS | M | -- | 736 | 540 | |
| 32 | **SAND (31.5'-38.0') SP**<br>Gray, wet, medium grained, well sorted, loose, very strong odor, petroleum sheen | | | 17 | 1.5/2 | SS | W | -- | 1202 | 922 | |
| 34 | 10<br>Some silt at 34.0'<br>Various small clay lenses at 36.0' | | | 18 | 0.5/2 | SS | W | -- | 1400 | 1001 | |
| 36 | | | | 19 | 0.5/2 | SS | W | -- | 1100 | 1270 | |
| 38 | **NO RECOVERY (38.0'-44.0')** | | | 20 | 0/2 | SS | -- | -- | -- | -- | |
| 40 | 12 | | | | | | | | | | |

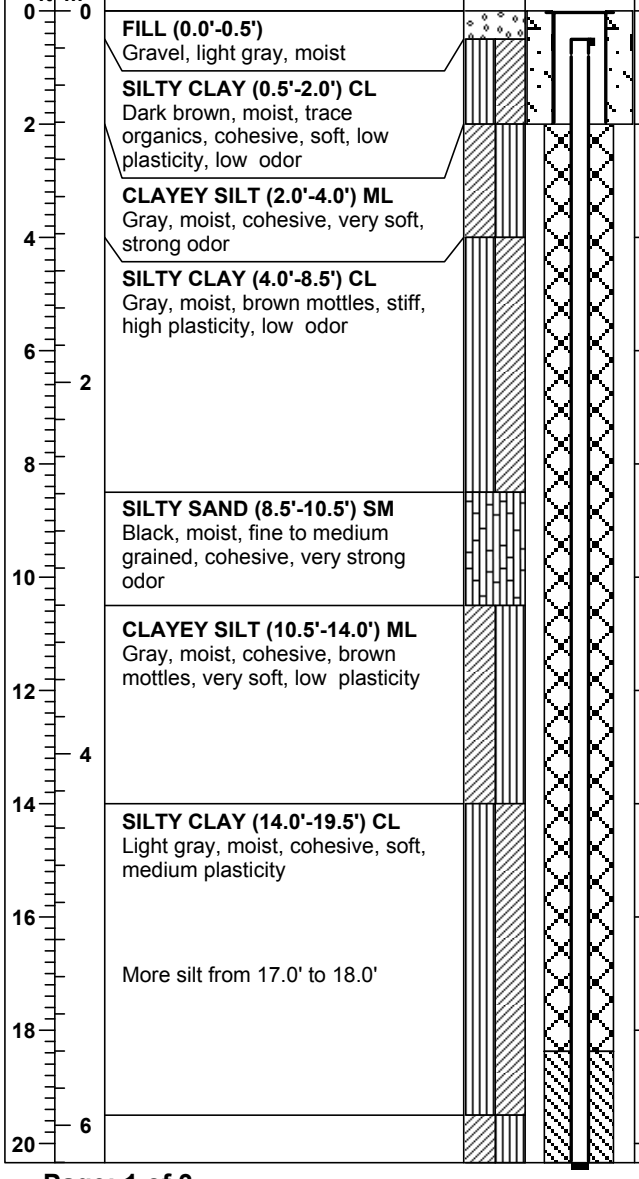
Clayton GROUP SERVICES

| BORING NO: HMW-30 | WELL NO: HMW-30 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | 21 | 0/2 | SS | -- | -- | -- | -- | |
| | | | | 22 | 0/2 | SS | -- | -- | -- | -- | |
| 44 | **SAND (44.0'-45.5') SP** Gray, wet, medium grained, well sorted, loose, very strong odor, petroleum sheen | | | 23 | 0.5/2 | SS | W | -- | 162 | 280 | |
| 46 14 | End of Boring at 45.5' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 16 | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 18 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: HMW-31 | WELL NO: HMW-31 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: 20ft SW of RW-4 | | | COORDINATES: 791156.20 N, 2317101.18 E |
| DRILLING CO: Phillips Environmental Services | | DRILLER: J. Bignall | LOGGED BY: J. Campbell |
| DRILLING EQUIP: Hollow Stem Auger | | SCREEN INTERVAL: 23.4' to 43.4' bgs | CHECKED BY: MMW |
| STATIC WATER LEVEL: NA | | SCREEN MTL/SLOT: PVC/0.010" | START DATE: 3/18/04 |
| BOREHOLE DIA: 8.25" | | STICKUP: Flushmount | START TIME (hours): 945 |
| TOP of CASING ELEVATION: 430.09' MSL | | G.S. ELEVATION: 430.50' MSL | FINISH DATE: 3/18/04 |
| RISER DIA/MTL/LGTH: 2"/PVC/23.0' | | DEV. METHODS: Double Whale pump | FINISH TIME (hours): 1345 |



| DEPTH (ft / m) | DESCRIPTION | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-0.5')** Gravel, light gray, moist | 1 | 1.5/2 | -- | M | -- | 28.5 | 29.3 | |
| 2 | **SILTY CLAY (0.5'-2.0') CL** Dark brown, moist, trace organics, cohesive, soft, low plasticity, low odor | 2 | 1.5/2 | SS | M | -- | 183 | 334 | |
| 4 | **CLAYEY SILT (2.0'-4.0') ML** Gray, moist, cohesive, very soft, strong odor | 3 | 2/2 | SS | M | -- | 3.1 | 17.1 | |
| 6 / 2 | **SILTY CLAY (4.0'-8.5') CL** Gray, moist, brown mottles, stiff, high plasticity, low odor | 4 | 2/2 | SS | M | -- | 3.1 | 13 | |
| 8 | | 5 | 1.5/2 | SS | M | -- | 5.6 | 4.6 | |
| 10 | **SILTY SAND (8.5'-10.5') SM** Black, moist, fine to medium grained, cohesive, very strong odor | 6 | 2/2 | SS | M | -- | 853 | 1192 | |
| 12 / 4 | **CLAYEY SILT (10.5'-14.0') ML** Gray, moist, cohesive, brown mottles, very soft, low plasticity | 7 | 2/2 | SS | M | -- | 1314 | 1289 | |
| 14 | **SILTY CLAY (14.0'-19.5') CL** Light gray, moist, cohesive, soft, medium plasticity | 8 | 2/2 | SS | M | -- | 9112 | 1519 | |
| 16 | More silt from 17.0' to 18.0' | 9 | 2/2 | SS | M | -- | 981 | 144 | |
| 18 | | 10 | 1/2 | SS | M | -- | 386 | 414 | |
| 20 / 6 | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-31 | WELL NO: HMW-31 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | **CLAYEY SILT (19.5'-23.5') ML** Light gray, moist, fine grained, cohesive, very soft, odor | | | 11 | 1.5/2 | SS | M | -- | 1309 | 774 | |
| | | | | 12 | 2/2 | SS | M | -- | 817 | 1255 | |
| 24 | **SAND (23.5'-24.5') SP** Gray, moist, fine grained, loose | | | | | | | | | | |
| | **SILTY CLAY (24.5'-25.0') CL** Gray, moist, brown mottles, cohesive, stiff, strong odor | | | 13 | 1.5/2 | SS | M | -- | 1422 | 996 | |
| 26 | **SILTY SAND (25.0'-28.0') SM** Gray, moist, fine to medium grained, cohesive | | | | | | | | | | |
| 8 | Wet, petroleum sheen at 28.0' | | | 14 | 1.5/2 | SS | M/W | -- | 815 | 1031 | |
| 28 | **CLAYEY SILT (28.0'-29.0') ML** Gray, wet, brown mottles, cohesive, very soft | | | 15 | 1.5/2 | SS | W/M | -- | 116 | 356 | |
| | **SILTY CLAY (29.0'-33.5') CL** Gray, moist, brown mottles, very stiff, high plasticity | | | | | | | | | | |
| 30 | Wood at 31.0' | | | 16 | 2/2 | SS | M | -- | 50.7 | 22.5 | |
| 32 | | | | 17 | 2/2 | SS | M/W | -- | 38.7 | 146 | |
| 10 | | | | | | | | | | | |
| 34 | **CLAYEY SAND (33.5'-34.0') SC** Gray, wet, fine grained, cohesive, petroleum sheen, strong odor | | | | | | | | | | |
| | **NO RECOVERY (34.0'-38.0')** | | | 18 | 0/2 | SS | -- | -- | -- | -- | |
| 36 | | | | 19 | 0/2 | SS | -- | -- | -- | -- | |
| 38 | **SAND (38.0'-44.0') SP** Gray, wet, medium grained, well sorted, loose, strong odor | | | 20 | 1/2 | SS | W | -- | 1730 | 616 | |
| 12 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

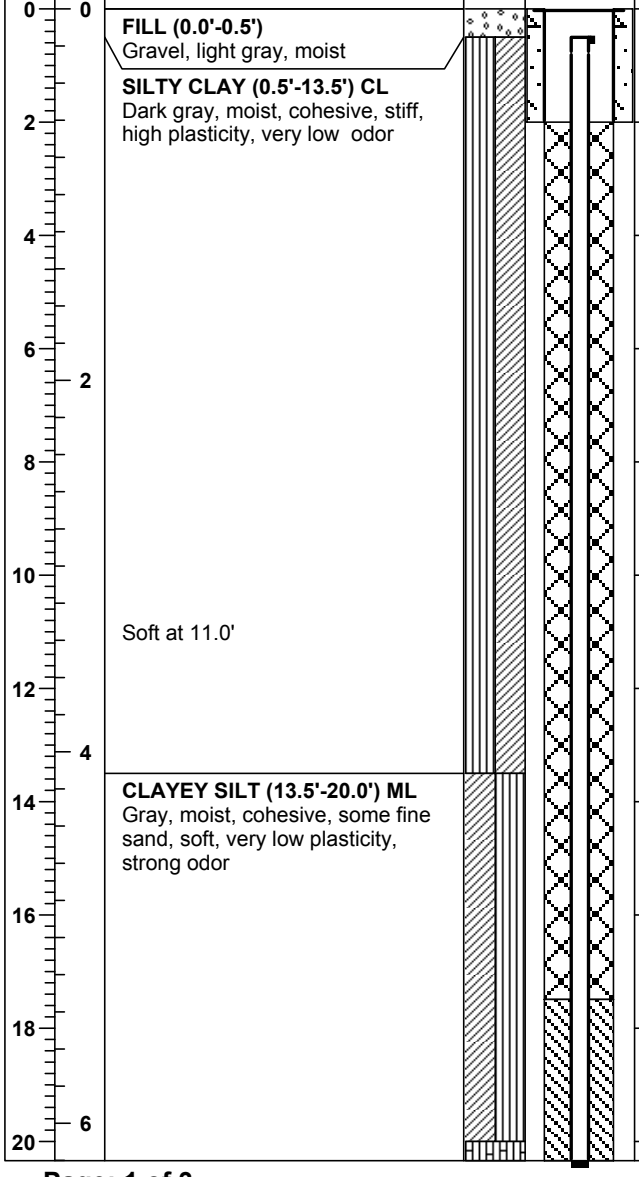
Clayton GROUP SERVICES

| BORING NO: HMW-31 | WELL NO: HMW-31 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES | | | | | PID | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | SCAN | HEADSPACE | |
| 42 | | | | 21 | 0/2 | SS | -- | -- | -- | -- | |
| | | | | 22 | 1.5/2 | SS | W | -- | 173 | 107 | |
| 44 | End of Boring at 44.0' | | | | | | | | | | |
| 46 | 14 | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | 16 | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 | 18 | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: HMW-32 | WELL NO: HMW-32 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: 35ft SW of RW-4 | | | COORDINATES: 791144.47 N, 2317110.94 E |
| DRILLING CO: Phillips Environmental Services | | DRILLER: J. Bignall | LOGGED BY: J. Campbell |
| DRILLING EQUIP: Hollow Stem Auger | | SCREEN INTERVAL: 22.5 to 42.5' bgs | CHECKED BY: MMW |
| STATIC WATER LEVEL: NA | | SCREEN MTL/SLOT: PVC/0.010" | START DATE: 3/18/04 |
| BOREHOLE DIA: 8.25" | | STICKUP: Flushmount | START TIME (hours): 1450 |
| TOP of CASING ELEVATION: 430.01' MSL | | G.S. ELEVATION: 430.38' MSL | FINISH DATE: 3/19/04 |
| RISER DIA/MTL/LGTH: 2"/PVC/22.1' | | DEV. METHODS: Double Whale pump | FINISH TIME (hours): 930 |




| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **FILL (0.0'-0.5')** Gravel, light gray, moist | | | 1 | 1/2 | SS | M | -- | 0.6 | 26.3 | |
| 0.5 | **SILTY CLAY (0.5'-13.5') CL** Dark gray, moist, cohesive, stiff, high plasticity, very low odor | | | 2 | 1.5/2 | SS | M | -- | 0 | 2.5 | |
| 4 | | | | 3 | 1.5/2 | SS | M | -- | 0 | 6.5 | |
| 6 | | | | 4 | 2/2 | SS | M | -- | 0 | 5.4 | |
| 8 | | | | 5 | 2/2 | SS | M | -- | 1.3 | 50.8 | |
| 10 | Soft at 11.0' | | | 6 | 2/2 | SS | M | -- | 8.7 | 103 | |
| 12 | | | | 7 | 2/2 | SS | M | -- | 1558 | 1502 | |
| 13.5 | **CLAYEY SILT (13.5'-20.0') ML** Gray, moist, cohesive, some fine sand, soft, very low plasticity, strong odor | | | 8 | 2/2 | SS | M | -- | 674 | 1236 | |
| 16 | | | | 9 | 2/2 | SS | M | -- | 125 | 339 | |
| 18 | | | | 10 | 1/2 | SS | M | -- | 565 | 724 | |
| 20 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-32 | WELL NO: HMW-32 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | **SILTY SAND (20.0'-24.0') SM** Gray, moist, fine grained, very soft, cohesive, odor | | | 11 | 0.5/2 | SS | M | -- | 148 | 373 | |
| | | | | 12 | 0.5/2 | SS | M | -- | 166 | 737 | |
| 24 | **SAND (24.0'-30.0') SP** Gray, moist, fine grained, loose, very well sorted | | | 13 | 0.5/2 | SS | M | -- | 98.4 | 136 | |
| 26 (8) | | | | 14 | 0.5/2 | SS | M | -- | 76.6 | 151 | |
| 28 | Wet from 29.0'-30.0' | | | 15 | 0.5/2 | SS | M/W | -- | 36.6 | 158 | |
| 30 | **CLAYEY SILT (30.0'-32.0') ML** Gray, moist, cohesive, soft, odor Wood at 31.0' | | | 16 | 1/2 | SS | M | -- | 70.6 | 1109 | |
| 32 (10) | **SILTY CLAY (32.0'-33.0') CL** Gray,wet, cohesive, stiff, low plasticity | | | 17 | 1/2 | SS | W | -- | 96.4 | 31.5 | |
| 34 | **SAND (33.0'-34.0') SP** Gray, wet, medium grained, loose, very well sorted | | | | | | | | | | |
| | **NO RECOVERY (34.0'-38.0')** | | | 18 | 0/2 | SS | -- | -- | -- | -- | |
| 36 | | | | 19 | 0/2 | SS | -- | -- | -- | -- | |
| 38 (12) | **SAND (38.0'-44.0') SW** Black, wet, fine to coarse grained, poorly sorted, loose, strong odor, petroleum sheen | | | 20 | 1/2 | SS | W | -- | 1538 | 1292 | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

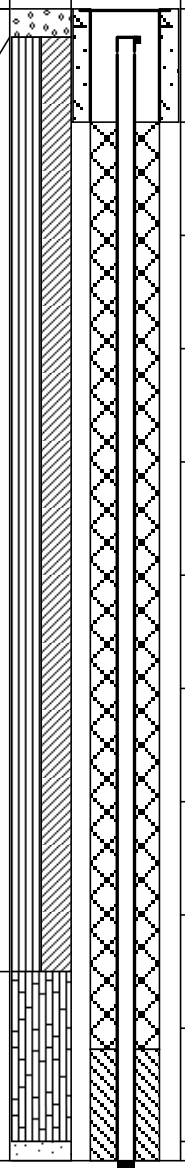
| BORING NO: HMW-32 | WELL NO: HMW-32 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | 21 | 1.5/2 | SS | W | -- | 67.2 | 285 | |
| | | | | 22 | 0/2 | SS | -- | -- | -- | -- | |
| 44 | End of Boring at 44.0' | | | | | | | | | | |
| 46 (14) | | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 (16) | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 (18) | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: HMW-33 | WELL NO: HMW-33 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: 55ft SW of RW-4 | | | COORDINATES: 791129.92 N, 2317123.08 E |
| DRILLING CO: Phillips Environmental Services | | DRILLER: J. Bignall | LOGGED BY: J. Campbell |
| DRILLING EQUIP: Hollow Stem Auger | | SCREEN INTERVAL: 23.5' to 43.4' bgs | CHECKED BY: MMW |
| STATIC WATER LEVEL: NA | | SCREEN MTL/SLOT: PVC/0.010" | START DATE: 3/19/04 |
| BOREHOLE DIA: 8.25" | | STICKUP: Flushmount | START TIME (hours): 1015 |
| TOP of CASING ELEVATION: 430.13' MSL | | G.S. ELEVATION: 430.54' MSL | FINISH DATE: 3/19/04 |
| RISER DIA/MTL/LGTH: 2"/PVC/23.0' | | DEV. METHODS: Double Whale pump | FINISH TIME (hours): 1410 |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-0.5')** Gravel, light gray, moist | | | 1 | 1/2 | SS | M | -- | 44.6 | 226 | |
| 2 | **SILTY CLAY (0.5'-17.0') CL** Dark brown, moist, cohesive, stiff, low plasticity, low odor, trace organics | | | 2 | 2/2 | SS | M | -- | 5.6 | 13.3 | |
| 4 | | | | 3 | 1.5/2 | SS | M | -- | 0.5 | 96.7 | |
| 6 / 2 | | | | 4 | 1.5/2 | SS | M | -- | 0 | 14 | |
| 8 | | | | 5 | 1.5/2 | SS | M | -- | 0 | 63.1 | |
| 10 | Grades soft at 10.0' | | | 6 | 2/2 | SS | M | -- | 3.3 | 256 | |
| 12 / 4 | | | | 7 | 2/2 | SS | M | -- | 120 | 629 | |
| 14 | Grades to gray green at 14.0' | | | 8 | 1.5/2 | SS | M | -- | 327 | 425 | |
| 16 | | | | 9 | 1.5/2 | SS | M | -- | 646 | 720 | |
| 18 | **SILTY SAND (17.0'-20.0') SM** Gray green, moist, fine grained, cohesive, very soft | | | 10 | 1/2 | SS | M | -- | 244 | 202 | |
| 20 / 6 | | | | | | | | | | | |





Boring/Well No.: HMW-33

Clayton GROUP SERVICES

| BORING NO: HMW-33 | WELL NO: HMW-33 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SAND (20.0'-21.5') SP** Gray green, moist, fine grained, loose, very well sorted | | | 11 | 1.5/2 | SS | M | -- | 380 | 337 | |
| 22 | **SILTY SAND (21.5'-23.0') SM** Gray green, moist, fine grained, trace clay, cohesive | | | 12 | 1/2 | SS | M | -- | 15.3 | 60.1 | |
| | **SAND (23.0'-25.5') SP** Dark gray, wet, fine grained, loose, very well sorted, low odor | | | 13 | 1/2 | SS | M/W | -- | 100 | 13.3 | |
| 24 | | | | | | | | | | | |
| 26 | **SILTY SAND (25.5'-28.5') SM** Dark gray, wet, fine grained, cohesive, low odor | | | 14 | 1/2 | SS | W | -- | 0 | 129 | |
| 8 | | | | | | | | | | | |
| 28 | **CLAY (28.5'-32.5') CL** Gray, moist, cohesive, some silt, very stiff, high plasticity | | | 15 | 1/2 | SS | W | -- | 5.6 | 62.3 | |
| 30 | Wood at 31.0' | | | 16 | -- | SS | M | -- | 0 | 307 | |
| 32 | | | | | | | | | | | |
| 10 | **SAND (32.5'-34.0') SP** Brown, wet, medium grained, very well sorted, loose, strong odor | | | 17 | -- | SS | W | -- | 1402 | 890 | |
| 34 | **NO RECOVERY (34.0'-38.0')** | | | 18 | 0/2 | SS | -- | -- | -- | -- | |
| 36 | | | | 19 | 0/2 | SS | -- | -- | -- | -- | |
| 38 | **SAND (38.0'-44.0') SW** Light gray, wet, fine to coarse grained, poorly sorted, loose | | | 20 | 0.5/2 | SS | W | -- | 1556 | 1074 | |
| 12 | | | | | | | | | | | |
| 40 | Clayey silt lense at 40.0' | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-33 | WELL NO: HMW-33 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | 21 | 0.5/2 | SS | W | -- | 1730 | 566 | |
| | | | | 22 | 0.5/2 | SS | W | -- | 16.3 | 331 | |
| 44 | End of Boring at 44.0' | | | | | | | | | | |
| 46 (14) | | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 (16) | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 (18) | | | | | | | | | | | |
| 60 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: HMW-34** | **WELL NO: HMW-34** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 18.9'-43.9' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 30.2 ft BGS** | **SCREEN MTL/SLOT: PVC/0.010"** | | **START DATE: 06/11/04** |
| **BOREHOLE DIA: 8"** | **STICKUP:** | | **START TIME (hours): 1100** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/11/04** |
| **RISER DIA/MTL/LGTH: 2"/PVC/19.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1600** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')** Grass underlain by topsoil | | | 1 | -- | LB | -- | NA | NA | NA | |
| 2 | **SILTY CLAY (1.0'-6.0') CL** Brown, moist, trace organics, high plasticity Grades stiff at 3.0' | | | 2 | 3/3 | LB | M | NA | 0 | 0.5 | |
| 4 | | | | | | | | | | | |
| 6 / 2 | **CLAYEY SILT (6.0'-10.0') ML** Brown, mottled, moist, some fine sand, very soft, cohesive | | | 3 | 5/5 | LB | M | NA | 0 | 4.1 | |
| 8 | | | | | | | | | | | |
| 10 | **SILT (10.0'-11.0') ML** Brown, wet,some fine sand,cohesive, mottled, well sorted | | | 4 | 3/5 | LB | W/M | NA | 0 | 3.4 | |
| 12 / 4 | **CLAYEY SILT (11.0'-13.5') ML** Bown, moist, very soft, mottled, cohesive | | | | | | | | | | |
| 14 | **SILT (13.5'-14.5') ML** Gray, wet, mottled, some fine sand, well sorted, cohesive | | | | | | | | | | |
| 16 | **CLAYEY SILT (14.5'-18.0') ML** Gray, moist, mottled, soft, very strong odor | | | 5 | 5/5 | LB | W/M | NA | 249 | 221 | |
| 18 / 6 | **SILT (18.0'-21.0') ML** Gray, moist, some fine sand, very well sorted, cohesive, very strong odor | | | | | | | | | | |
| 20 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-34 | WELL NO: HMW-34 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | **SAND (21.0'-22.0') SP** Gray, saturated, fine grained, some silt, loose, sheen | | | 6 | 4/5 | LB | S/W | NA | >2000 | >2000 | |
| | **CLAYEY SILT (22.0'-25.0') ML** Gray, wet, cohesive, mottled | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 26 | **CLAY (25.0'-26.5') CL** Gray, moist, very stiff, high plasticity, fat | | | 7 | 5/5 | LB | M/W | NA | 0 | 1864 | |
| 8 | **SILT (26.5'-27.0') ML** Gray, wet, soft, cohesive, very well sorted, some fine sand | | | | | | | | | | |
| 28 | **CLAY (27.0'-30.0') CL** Gray, moist, very stiff, high plasticity, fat | | | | | | | | | | |
| 30 | **SAND (30.0'-46.0') SP** Gray, wet, fine to medium grained, well sorted, loose, strong odor | | | 8 | 3/5 | LB | M/W | NA | -- | 1916 | |
| 32 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 34 | | | | 9 | 1/2 | SS | W | 1<br>2<br>6<br>9 | -- | 1467 | |
| 36 | | | | 10 | 1/2 | SS | W | 5<br>7<br>8<br>12 | -- | 1385 | |
| 38 | | | | 11 | 1.5/2 | SS | W | 5<br>7<br>11<br>17 | -- | 1961 | |
| 12 | Grades with coarse sand, fine gravel at 39.0' | | | | | | | | | | |
| 40 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-34 | WELL NO: HMW-34 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES | | | | | PID | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | SCAN | HEADSPACE | |
| 42 | | | | 12 | 1/2 | SS | W | 5<br>7<br>10<br>11 | -- | 1344 | |
| 44 | | | | 13 | 1/2 | SS | W | 5<br>8<br>11<br>11 | -- | 1267 | |
| 46 | 14 | | | 14 | 2/2 | SS | W | 6<br>9<br>14<br>18 | -- | 781 | |
| | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | 16 | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |
| 58 | | | | | | | | | | | |
| 60 | 18 | | | | | | | | | | |



Boring/Well No.: HMW-34

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: HMW-35** | **WELL NO: HMW-35** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 18.5'-43.5' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 26.6 ft BGS** | **SCREEN MTL/SLOT: PVC/0.010"** | | **START DATE: 06/12/04** |
| **BOREHOLE DIA: 8"** | **STICKUP:** | | **START TIME (hours): 0845** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/12/04** |
| **RISER DIA/MTL/LGTH: 2"/PVC/18.5'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1700** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')** Grass underlain by topsoil | | | 1 | -- | LB | -- | NA | NA | NA | |
| 2 | **SILTY CLAY (1.0'-7.5') CL** Brown, moist, trace organics, soft, medium plasticity, cohesive Grades stiff at 4.5' | | | 2 | 2/3 | LB | M | NA | 0 | 5.5 | |
| 4 | | | | | | | | | | | |
| 6 / 2 | | | | 3 | 4/5 | LB | M | NA | 0 | 15 | |
| 8 | **CLAYEY SILT (7.5'-10.0') ML** Light brown, moist, mottled, soft, low plasticity, cohesive | | | | | | | | | | |
| 10 | **SILT (10.0'-11.5') ML** Brown, wet,some clay, very well sorted, cohesive | | | | | | | | | | |
| 12 | **CLAYEY SILT (11.5'-12.5') ML** Gray, wet, low plasticity, cohesive, soft | | | 4 | 5/5 | LB | M/W | NA | 25.3 | 5 | |
| 4 | **SILT (12.5'-14.5') ML** Gray, saturated, very well sorted, some fine sand, strong odor | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | **CLAYEY SILT (14.5'-19.0') ML** Brown, moist, mottled, soft, cohesive, low plasticity, slight odor | | | 5 | 4.5/5 | LB | S/M | NA | 424 | 1042 | |
| 18 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-35 | WELL NO: HMW-35 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **SILT (19.0'-20.0') ML** Gray, moist, some fine sand, very strong odor<br>**CLAYEY SILT (20.0'-21.0') ML** Gray, moist, cohesive, low plasticity, soft<br>**SAND (21.0'-22.5') SP** Gray, saturated, fine grained, some silt, loose | | | 6 | 4/5 | LB | M/S | NA | >2000 | >2000 | |
| 23 | 7 **SILTY CLAY (22.5'-27.3') CL** Gray, moist, mottled, stiff, medium plasticity<br>3-inch silt seam, saturated at 24.5' | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 27 | 3-inch silt seam, saturated at 27.0' | | | 7 | 5/5 | LB | M | NA | 988 | 1749 | |
| 29 | **CLAY (27.3'-30.0') CL** Gray, moist, very stiff, high plasticity, fat<br>3-inch sand seam, medium grained, moist at 28.5' | | | | | | | | | | |
| | 9 | | | | | | | | | | |
| 31 | **SAND (30.0'-46.0') SP** Gray, saturated, fine to medium grained, well sorted, loose, strong odor | | | 8 | 3/5 | LB | M/S | NA | 1902 | 1979 | |
| 33 | | | | | | | | | | | |
| 35 | | | | 9 | 1.5/2 | SS | S | 3<br>6<br>12<br>16 | >2000 | 1444 | |
| | 11 | | | | | | | | | | |
| 37 | | | | 10 | 1/2 | SS | S | 7<br>7<br>7<br>9 | >2000 | 1371 | |

Clayton GROUP SERVICES

| BORING NO: HMW-35 | WELL NO: HMW-35 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | Grades with coarse sand, fine gravel at 39.0' | | | 11 | 0.8/2 | SS | S | 7<br>4<br>9<br>12 | >2000 | 1888 | |
| | | | | 12 | 1.2/2 | SS | S | 9<br>10<br>12<br>10 | 1933 | 1494 | |
| 42 | | | | | | | | | | | |
| 13 | | | | 13 | 1/2 | SS | S | 4<br>8<br>9<br>12 | 500 | 927 | |
| 44 | | | | | | | | | | | |
| | | | | 14 | 1/2 | SS | S | 5<br>8<br>15<br>18 | 197 | 746 | |
| 46 | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |



Boring/Well No.: HMW-35

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| BORING NO: HMW-36 | WELL NO: HMW-36 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
| BORING LOCATION: Hartford, Illinois | | COORDINATES: | |
| DRILLING CO: Phillips Environmental Services | DRILLER: J. Bignall | | LOGGED BY: J. Campbell |
| DRILLING EQUIP: CME-75/HSA | SCREEN INTERVAL: 19.2'-44.2' bgs | | CHECKED BY: MMW |
| STATIC WATER LEVEL: 26.7 ft BGS | SCREEN MTL/SLOT: PVC/0.010" | | START DATE: 06/13/04 |
| BOREHOLE DIA: 8" | STICKUP: | | START TIME (hours): 0840 |
| TOP of CASING ELEVATION: | G.S. ELEVATION: | | FINISH DATE: 06/13/04 |
| RISER DIA/MTL/LGTH: 2"/PVC/19.2' | DEV. METHODS: NA | | FINISH TIME (hours): 1405 |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')**<br>Grass underlain by topsoil | | | 1 | -- | LB | -- | NA | NA | NA | |
| 2 | **SILTY CLAY (1.0'-7.0') CL**<br>Brown, moist, trace coarse sand, trace organics, stiff, high plasticity | | | 2 | 1.5/3 | LB | M | NA | 4 | 40.1 | |
| 4 | | | | | | | | | | | |
| 6 / 2 | | | | 3 | 5/5 | LB | M | NA | 0 | 37 | |
| 8 | **CLAYEY SILT (7.0'-9.5') ML**<br>Light brown, moist, mottled,very soft, low plasticity | | | | | | | | | | |
| 10 | **SANDY SILT (9.5'-12.0') ML**<br>Light brown, moist, mottled, slightly cohesive<br><br>Saturated at 11.5' | | | 4 | 4/5 | LB | M/S | NA | 404 | 305 | |
| 12 / 4 | **CLAYEY SILT (12.0'-13.0') ML**<br>Gray, moist, very soft, low plasticity, cohesive | | | | | | | | | | |
| 14 | **SILT (13.0'-16.0') ML**<br>Gray, saturated, slightly cohesive, very strong odor<br><br>Grades clay at 14.0' | | | 5 | 5/5 | LB | S/M | NA | 976 | 288 | |
| 16 | **SILTY CLAY (16.0'-19.0') CL**<br>Gray with brown mottles, moist, soft, cohesive,medium plasticity | | | | | | | | | | |
| 18 | | | | | | | | | | | |

Clayton GROUP SERVICES

| BORING NO: HMW-36 | WELL NO: HMW-36 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **SILT (19.0'-22.5') ML** Gray, moist, trace clay, some fine sand, very soft, cohesive, Saturated, very strong odor at 22.0' | | | 6 | 4/5 | LB | M | NA | >2000 | 1897 | |
| 23 | **SILTY CLAY (22.5'-30.5') CL** Gray with brown mottles, moist, medium plasticity, soft | | | | | | | | | | |
| 25 | | | | 7 | 5/5 | LB | M | NA | >2000 | >2000 | |
| 27 | Silt seam, saturated at 27.5' Grades more clay, stiff, high plasticity at 29.0' | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 31 | **SAND (30.5'-46.0') SP** Gray, saturated, fine to medium grained, well sorted, loose, very strong odor | | | 8 | 2.5/5 | LB | M/S | NA | >2000 | 1009 | |
| 33 | | | | | | | | | | | |
| 35 | | | | 9 | 1/2 | SS | S | 1 2 2 3 | >2000 | 1362 | |
| 37 | | | | 10 | 0.8/2 | SS | S | 2 2 4 6 | >2000 | 1594 | |

Clayton GROUP SERVICES

| BORING NO: HMW-36 | WELL NO: HMW-36 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | Grades with coarse sand, fine gravel at 39.0' | | | 11 | 0.8/2 | SS | S | - - - - | >2000 | >2000 | |
| 42 | | | | 12 | 1/2 | SS | S | 2 6 11 15 | 1805 | 955 | |
| 13 | | | | 13 | 0.8/2 | SS | S | - - - - | 1160 | 515 | |
| 44 | | | | 14 | 1.5/2 | SS | S | - - - - | 480 | 1004 | |
| 46 | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |

Clayton GROUP SERVICES

| | | | |
|---|---|---|---|
| **BORING NO: HMW-37** | **WELL NO: HMW-37** | **PROJECT NO: 15-03095.13-001** | **PROJECT NAME: Hartford Working Group** |
| **BORING LOCATION: Hartford, Illinois** | | **COORDINATES:** | |
| **DRILLING CO: Phillips Environmental Services** | **DRILLER: J. Bignall** | | **LOGGED BY: J. Campbell** |
| **DRILLING EQUIP: CME-75/HSA** | **SCREEN INTERVAL: 19.0'-44.0' bgs** | | **CHECKED BY: MMW** |
| **STATIC WATER LEVEL: 26.4 ft BGS** | **SCREEN MTL/SLOT: PVC/0.010"** | | **START DATE: 06/14/04** |
| **BOREHOLE DIA: 8"** | **STICKUP:** | | **START TIME (hours): 0745** |
| **TOP of CASING ELEVATION:** | **G.S. ELEVATION:** | | **FINISH DATE: 06/14/04** |
| **RISER DIA/MTL/LGTH: 2"/PVC/19.0'** | **DEV. METHODS: NA** | | **FINISH TIME (hours): 1430** |

| DEPTH (ft / m) | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | RECOVERY | METHOD | MOISTURE | BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | **FILL (0.0'-1.0')** Grass underlain by topsoil | | | 1 | -- | LB | -- | NA | NA | NA | |
| 2 | **SILTY CLAY (1.0'-9.0') CL** Dark brown, moist, trace organics, low plasticity, soft, cohesive | | | 2 | 2/3 | LB | M | NA | 0 | 0 | |
| 4 | | | | | | | | | | | |
| 6 / 2 | Grades light brown mottled, soft, high plasticity at 5.5' | | | 3 | 5/5 | LB | M | NA | 0 | 0 | |
| 8 | | | | | | | | | | | |
| 10 | **CLAYEY SILT (9.0'-12.5') ML** Light brown, moist, mottled,very soft, low plasticity | | | 4 | 4/5 | LB | M/S | NA | 83.8 | 60.4 | |
| 12 / 4 | **SILT (12.5'-14.0') ML** Gray, saturated, very well sorted, trace clay | | | | | | | | | | |
| 14 | **SILTY CLAY (14.0'-18.5') CL** Gray, moist, soft, medium plasticity, very strong odor | | | 5 | 5/5 | LB | M/W | NA | 979 | 266 | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |



**Boring/Well No.: HMW-37**

Clayton GROUP SERVICES

| BORING NO: HMW-37 | WELL NO: HMW-37 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | **CLAYEY SILT (18.5'-26.0') ML**<br>Gray,wet, very soft, low plasticity<br><br>Saturated silt seam at 22.0'<br><br>Saturated silt seam at 23.5' | | | 6 | 5/5 | LB | W | NA | 568 | 102 | |
| 23 — 7 | | | | | | | | | | | |
| 25 | | | | 7 | 5/5 | LB | W/M | NA | 0 | 36.8 | |
| 27 | **CLAY (26.0'-30.0') CL**<br>Gray, moist, stiff, high plasticity | | | | | | | | | | |
| 29 — 9 | | | | | | | | | | | |
| 31 | **SAND (30.0'-46.0') SP**<br>Gray, saturated, fine to medium grained, loose, very strong odor | | | 8 | 1.5/5 | LB | M/S | NA | 0 | 1103 | |
| 33 | | | | | | | | | | | |
| 35 | | | | 9 | 1/2 | SS | S | 3<br>8<br>12<br>15 | >2000 | 1700 | |
| 37 — 11 | | | | 10 | 1/2 | SS | S | 3<br>6<br>6<br>10 | >2000 | 1368 | |

Clayton GROUP SERVICES

| BORING NO: HMW-37 | WELL NO: HMW-37 | PROJECT NO: 15-03095.13-001 | PROJECT NAME: Hartford Working Group |
|---|---|---|---|

| DEPTH | DESCRIPTION | GRAPHIC | WELL | SAMPLES NUMBER | SAMPLES RECOVERY | SAMPLES METHOD | SAMPLES MOISTURE | SAMPLES BLOW CNT (6") | PID SCAN | PID HEADSPACE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | Grades with coarse sand, fine gravel at 40.0' | | | 11 | 0.8/2 | SS | S | 1<br>3<br>3<br>5 | >2000 | 1281 | |
| | | | | 12 | 1/2 | SS | S | 3<br>5<br>9<br>11 | >2000 | 809 | |
| 42 | | | | | | | | | | | |
| 13 | | | | 13 | 1.5/2 | SS | S | 6<br>10<br>15<br>18 | >2000 | 1743 | |
| 44 | | | | 14 | 1/2 | SS | S | -<br>-<br>-<br>- | 138 | 209 | |
| 46 | End of Boring at 46.0' | | | | | | | | | | |
| 48 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 50 | | | | | | | | | | | |
| 52 | | | | | | | | | | | |
| 54 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 56 | | | | | | | | | | | |

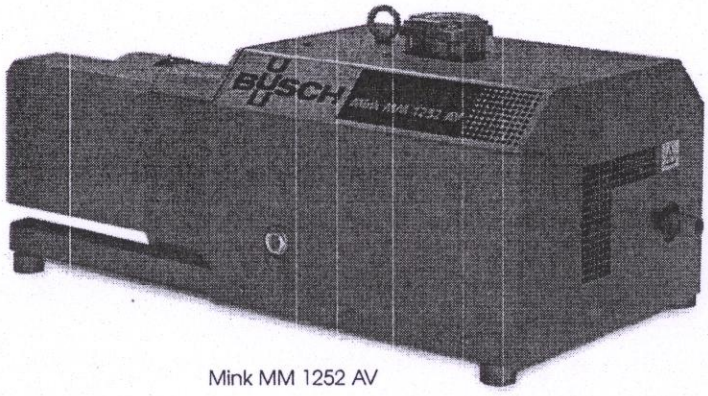


Boring/Well No.: HMW-37

# MINK DRY CLAW VACUUM PUMP

## MODEL: MM 1252 AV

NEW




Mink MM 1252 AV

## DESCRIPTION

The Busch MM Series positive displacement vacuum pumps feature a compact rotary claw design that is air cooled, dry-running and non-contacting. These features along with quality construction results in a pump that offers extremely high reliability and a long service life.

## ECONOMICAL

Operating costs are low because of the maintenance-free design and the reduced power requirements made possible by the MM's high volumetric efficiency along with a zero-friction pumping chamber.

## MAINTENANCE-FREE

Non-contacting design – eliminates internal wear and parts to replace

Air Cooling – no water levels to check and no cooling system to maintain

Dry-Running – no sealing or lubricating oil is needed in the pumping chamber, so there is minimal maintenance

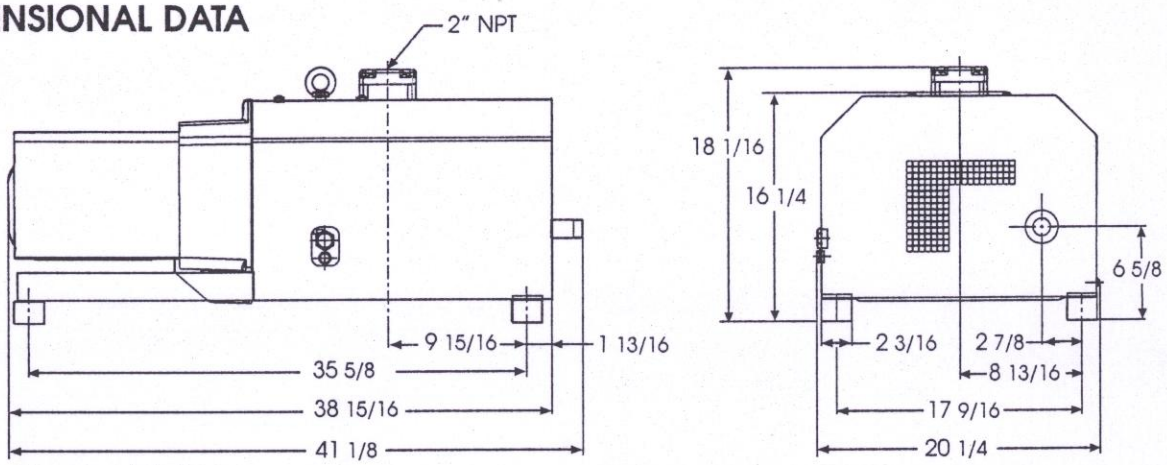
## STANDARD SPECIFICATIONS

| Mink Model | | MM 1252 AV |
|---|---|---|
| Nominal pumping speed | ACFM | 165 |
| Free air displacement | CFM | 177 |
| Sound level rating | dBA | 79 |
| Ultimate pressure (continuous duty) | Torr | 75 |
| Ultimate pressure (intermittent duty) | Torr | 37.5 |
| Motor size | kW (HP) | 5.5 (7.4) |
| Motor rotational speed | RPM | 3600 |
| Weight (approx) | Lbs | 528 |

# MINK DRY CLAW VACUUM PUMP

## MODEL: MM 1252 AV

## DIMENSIONAL DATA

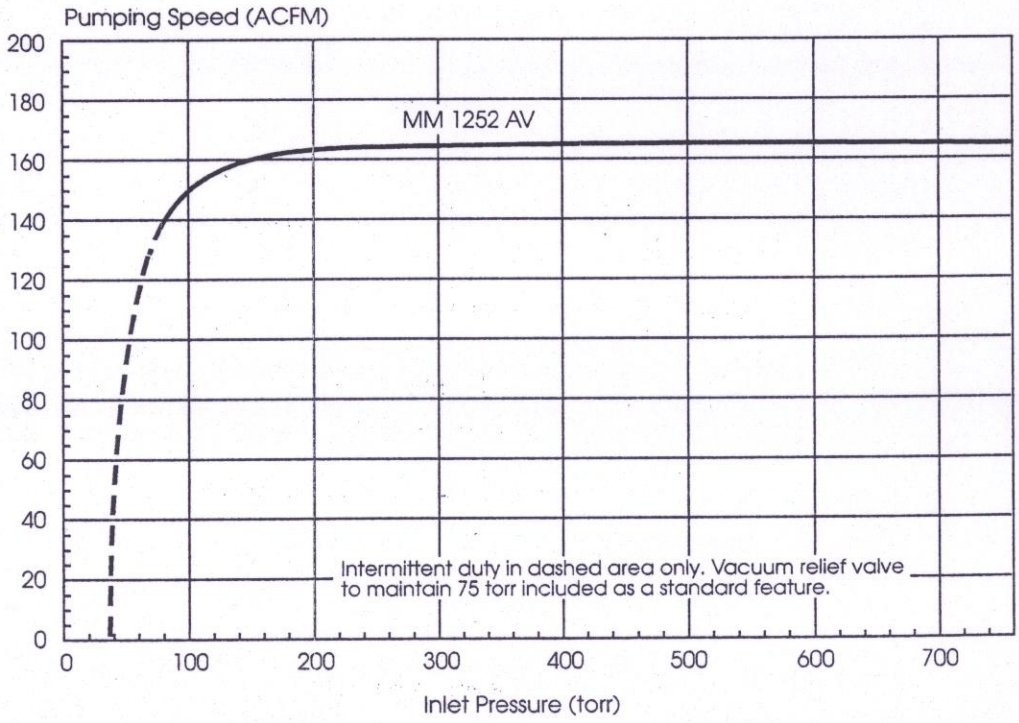



Dimensions in inches

## PERFORMANCE DATA

(Based on 60 cycle motor)

Pumping Speed vs. Inlet Pressure

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www.buschpump.com

**For more information call**
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Holland, Spain, Switzerland, Sweden, Turkey, Denmark, England, Australia, Italy, France, China, Germany, Taiwan, Japan, Austria, Canada

# *Technical White Paper*

## Rotary Claw Vacuum Technology

Prepared By

Peter Keays, PEng.
System Designs Engineer

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www.maple-leaf.ca

# *Technical White Paper*

## Rotary Claw Vacuum Technology

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# *Technical White Paper*
## Rotary Claw Vacuum Technology

## 1.0 Introduction: Rotary Claw vs. Liquid Ring

The rotary-claw pump/compressor, a well-established standard in many industries due to its inherent efficiency, has long been cost-prohibitive for soil remediation vacuum applications.

Now, innovative new designs like the 'Mink' from Busch Vacuum Technics are bringing this technology into the mainstream, and stealing the spotlight from that venerable old workhorse, the liquid-ring pump (LRP).

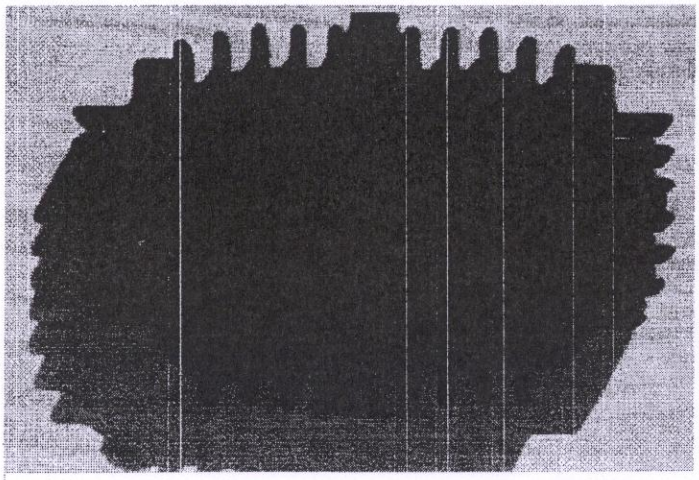

Figure 1: An inside view of the rotary-claw pump chamber

## 2.0 What is a rotary claw compressor?

Rotary-claw compressors are not new; they have been used in commercial applications in North America since the early 1990's, and since the mid-80's in Japan.

At first glance, the inner-workings of a claw pump appear quite similar to those of a rotary-lobe or Roots-type blower. Like the rotary-lobe, the claw is a 'dry' positive-displacement pump meaning that there is no lubricant or sealing fluid in the pumping chamber; only close mechanical tolerances between the chamber casing and the precision-machined rotors or 'claws' provide the seal required.

In contrast however, each of the two claw rotors has a unique profile so that as they counter-rotate separate expansion and compression chambers are created. Dry-operation and internal compression are the key ingredients of the highly efficient claw principle.


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## 3.0 The Rotary Claw Operating Principle

Driven through a set of exterior precision gears mounted on parallel shafts, two claw rotors rotate in opposite directions within the pumping chamber. There is no lubrication required in the chamber. The claws do not touch each other, nor do they touch the chamber walls. Figure 2 captures the key steps of the process as described below:

Position 1: A volume of air is captured at the inlet by the expanding space created as the claws rotate.

Position 2: Each claw effectively traps a fixed volume of air for part of the rotation.

Position 3: The two volumes of air are recombined and compressed until the exhaust port is exposed. Tolerance is very tight at the 'would-be' contact point of the claws to prevent backflow from the pressure side to the vacuum side.

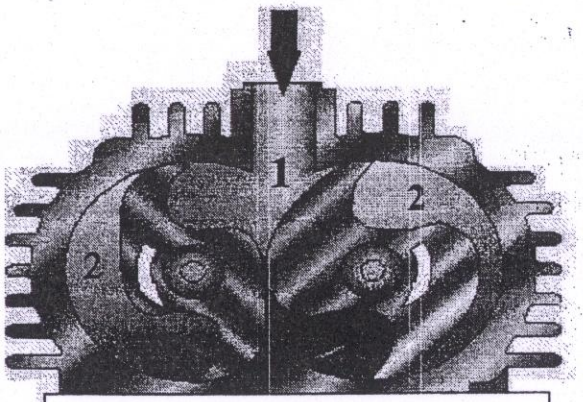


**Figure 2: Cut-away view of the claw process.**

**One full rotation of the claws is equivalent to two expansion/compression cycles.**

**While one charge is being compressed and expelled, a fresh charge is being simultaneously drawn in.**

## 4.0 Range of application

Airflow and vacuum/pressure capacities vary according to manufacturer and model. The Busch Mink MM-series single-stage pump is capable of continuous operation at 22 in. Hg vacuum (28.2 in. Hg max.) at flow rates, depending on the specific model, from 44 acfm to over 210 acfm. Larger airflows can be attained by connecting two or more units in parallel. In soil remediation terms, this constitutes a range of operation formerly dominated by liquid-ring pumps.

Also noteworthy, the same model line in compressor configuration can produce flows of over 90scfm at 15psig, or 65scfm at pressures as high as 22psig, making it a suitable alternative for many air-sparging applications.


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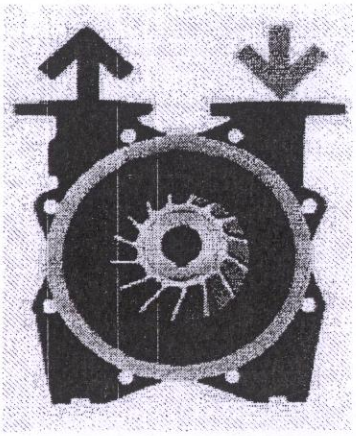
# 5.0 Advantages of Rotary Claw Pumps vs. Liquid Ring Pumps

## 5.1 Clean

The rotary claw is a dry pump. There is nothing in the pumping chamber to contaminate the air stream. Unlike liquid ring pump systems, there is no fear of oil-carryover or leaks.

**Figure 3: Cut-away view of a liquid-ring pump. Air flow necessarily contacts the sealing ring (blue) causing cross-contamination.**

**Energy is wasted as the impeller acts upon the liquid to maintain a seal.**



## 5.2 Efficient

In comparison to a liquid ring pump, the efficiency advantage of the rotary claw process is obvious. Liquid-ring pumps consume significant energies in maintaining the liquid ring or seal. One can imagine each vane of the impeller pushing a volume of liquid, be it oil or water, around the pump housing on each revolution. Also, there are losses associated with reclaiming, cooling, and returning liquid that is carried over from the exhaust flow into downstream piping.

Additionally, a heat exchanger must be installed in return line, consuming additional energy with no direct benefit to the actual pumping process.

The rotary-claw pump has no seal liquid to push around, and air-cooling is easily achieved with a small integrated fan. As a result, a rotary-claw pump can produce a vacuum-flow at typically 25% less horsepower than an equivalent liquid-ring pump, which translates directly into significant operational-cost savings.

**As an example:**

Based on published pump flow and power data, a flow of 425acfm at 22"hg one could be achieved with a 40hp LRP, or with two 15hp claw pumps operating in parallel. This does not take into account additional horsepower required for cooling the sealing liquid in an LRP system.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## 5.3 Low maintenance

A typical LRP system employs a myriad of connections and components, each of which represent a potential for future problems. Liquid levels must be regularly adjusted, monitored, and maintained.

The claw compressor has two small gears in a closed oil bath; regular maintenance is as simple as periodically checking the oil. The pump rotors and chamber are non-contacting, and that means no wear.

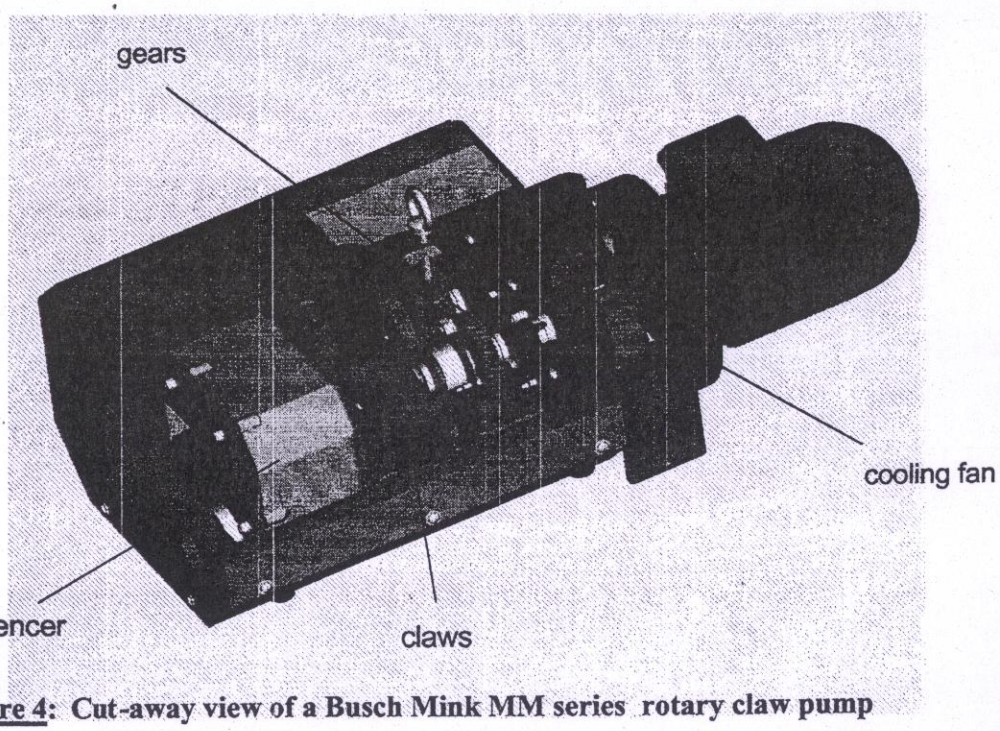


**Figure 4: Cut-away view of a Busch Mink MM series rotary claw pump**

## 5.4 VFD compatible

Claw vacuum pumps are suitable for use with variable frequency drives. Suction capacity verses motor speed is almost linear so that capacity can be easily adjusted to suit the application.

In such a case, wasteful dilution or bleed lines can be eliminated.

Additionally, with a suitable VFD-capable motor some pumps can be operated at up to 3800 rpm to take advantage of reserve capacity.


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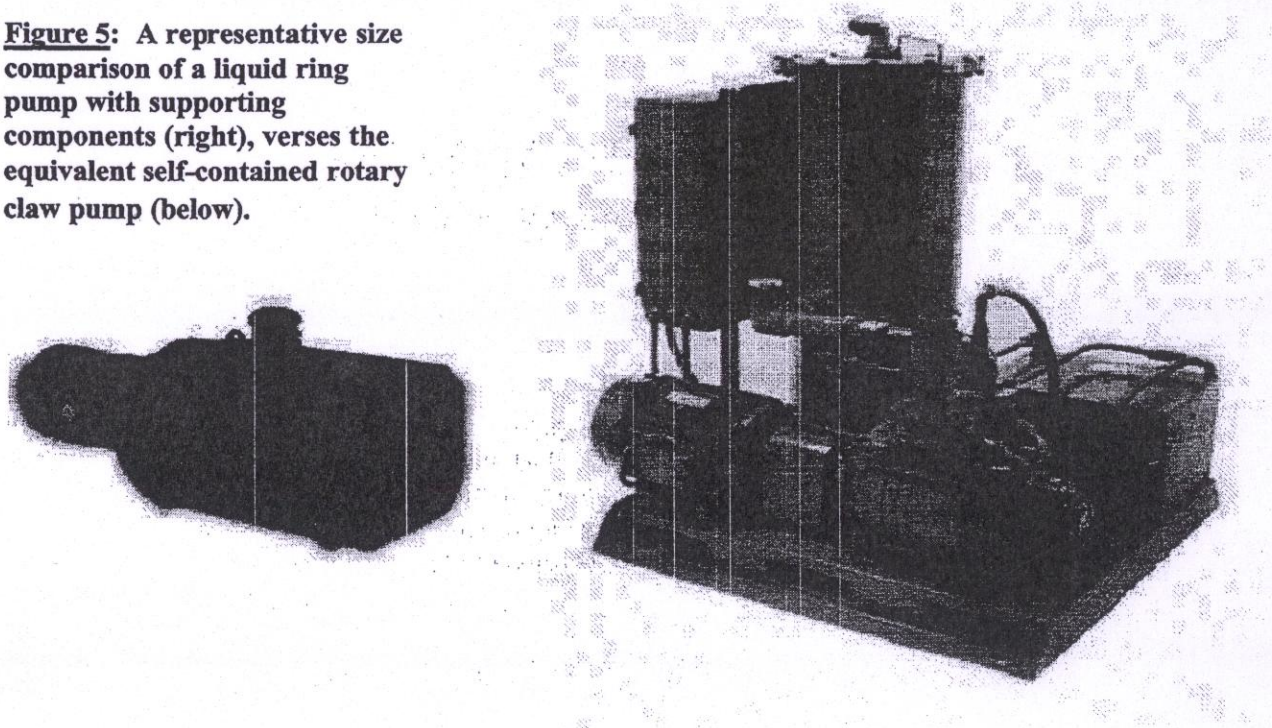
## 5.5 Compact

In comparison to the liquid-ring pump, the rotary claw is also dramatically space efficient. Although a liquid ring pump is compact in itself, there is the supporting system componentry to consider. A complete LRP system including pump, motor, seal-fluid tank, and heat exchanger can easily consume four or more times the floor space of the pump and motor alone. There is also the vertical space and added weight to consider, both of which can be of significance when considering site layout or shipping costs.

A claw pump is self-contained, occupying a fraction of the space of an equivalent LRP system.

**Figure 5: A representative size comparison of a liquid ring pump with supporting components (right), verses the equivalent self-contained rotary claw pump (below).**



## 5.6 Simple and affordable

Rotary claw technology is now competitive with LRP systems on a cost basis thanks to simplified and effective modern designs. As an example, the Busch Mink model line has been redesigned to reduce the number of parts and to create a modular unit. Benefits include increased efficiency, ease of maintenance, quieter operation, and reduced cost.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## 6.0 Setting a new standard for soil remediation vacuum

The modern rotary claw is the product of an established technology that has come of age. Liquid-ring pumps may still have a place in soil remediation. However, for applications requiring flows up to 300 acfm and at continuous vacuum levels up to 22"Hg,, the rotary-claw offers competitive cost and none of the problems commonly associated with the LRP process. The rotary claw vacuum pump can be expected to quickly move to the forefront of popularity for SVE/MPE applications.

## 7.0 About Maple Leaf Environmental Equipment

Maple Leaf Environmental Equipment designs, builds, commissions, and supports systems for soil remediation. The systems range from single well pumping systems to large combined soil vapor extraction/groundwater pump and treatment systems. Systems are highly customized, designed specifically to provide innovative solutions for our customer's unique requirements. MLEE also distributes a range of environmental products, which includes: pumps, sampling equipment, air strippers, and carbon filters. MLEE is the Canadian master distributor for QED, the leading environmental product sampling equipment in North America. Key customers include leading environmental engineering consulting firms, and large environmental contracting firms. Sales and support in Canada and the United States are provided through an established network of outstanding rep firms. MLEE is known in the industry for its professional, long-term approach to the business, delivering quality solutions to support our rep partners and customers success.

**About the Author**

Peter Keays joined Maple Leaf Environmental Equipment in 2002 as a System Designs Engineer. He has developed hands-on experience in all phases of design and manufacturing of MLEE process systems. Peter is a Mechanical Engineering graduate of Queens University at Kingston Ontario (1992) and an active member of Professional Engineers Ontario – Thousand Islands Chapter. Peter has ten years experience in manufacturing prior to joining Maple Leaf Environmental Equipment.

Figures are courtesy of **Busch Vacuum Technics Inc.**, Boisbriand Quebec. **Busch** is a world leader in industrial vacuum/pressure technology with manufacturing facilities Germany, Switzerland, Denmark, and USA. The Mink rotary-claw pump is part of the broad Busch product portfolio.


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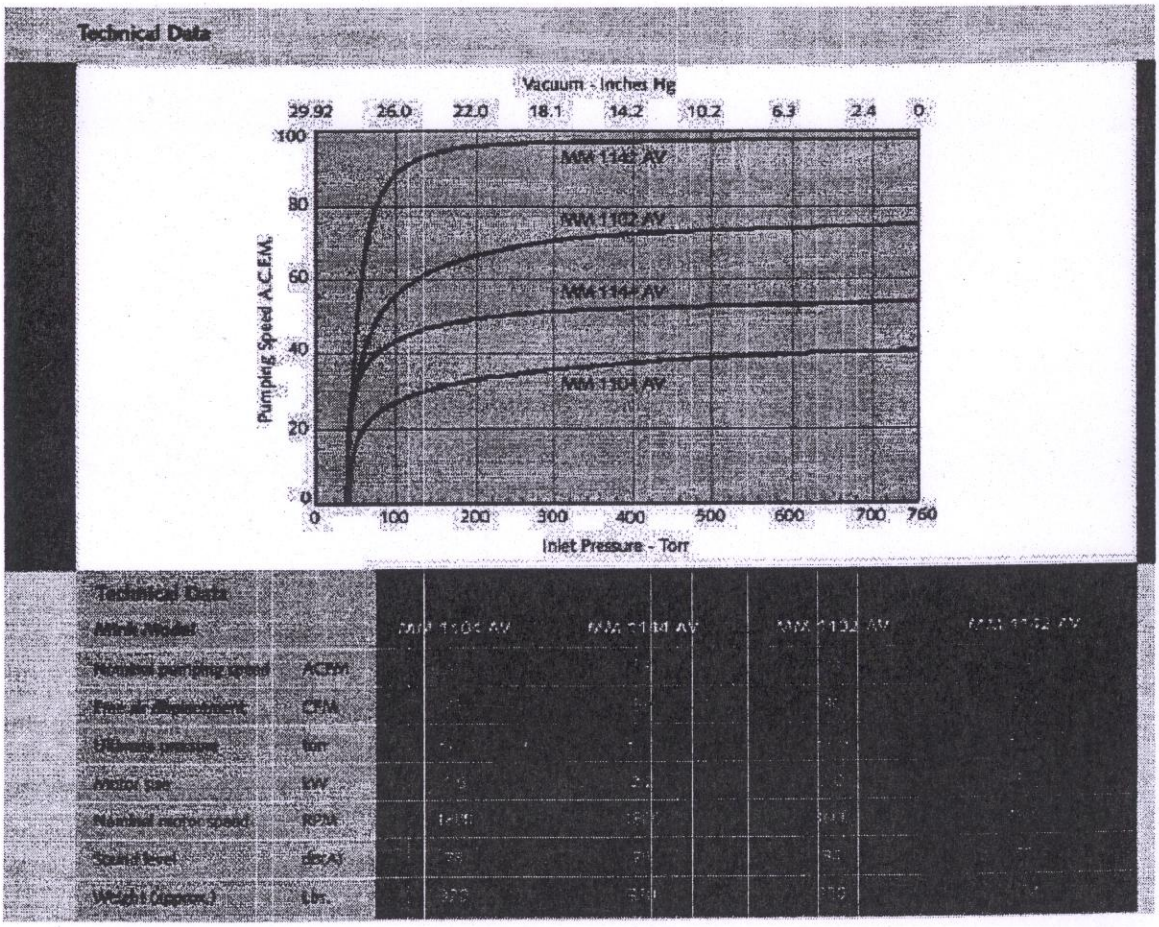
# *Technical White Paper*

## Rotary Claw Vacuum Technology

| STANDARD SPECIFICATIONS FOR VACUUM MODELS | | | | |
|---|---|---|---|---|
| **Model** | **MM1104AV** | **MM1144AV** | **MM1102AV** | **MM1142AV** |
| Nom. pump. speed (ACFM) | 40 | 53 | 74 | 97 |
| Free air displacement (CFM) | 43 | 58 | 86 | 116 |
| SCFM@ 15" Hg | 18 | 25.5 | 35.5 | 48 |
| SCFM@19" Hg | 13 | 18 | 25 | 34 |
| SCFM@25" Hg | 4.8 | 7.4 | 9.4 | 14 |
| End vacuum ("Hg) (<torr>) | 28.5 <37.5> | 28.5 <37.5> | 28.5 <37.5> | 28.5 <37.5> |
| Motor rating (HP) (<kW>) | 2 <1.5> | 3 <2.2> | 4 <3.0> | 5 <4.0> |
| Motor speed (RPM @ 60Hz) | 1800 | 1800 | 3600 | 3600 |
| Approximate weight (lbs) | 320 | 330 | 330 | 352 |
| Inlet pipe connection (NPS) | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" |
| Discharge pipe connection | 1" | 1" | 1" | 1" |
| Sound level dBA | 78 | 79 | 84 | 85 |
| Gear box oil capacity (approx. liters) | .45 | .45 | .45 | .45 |



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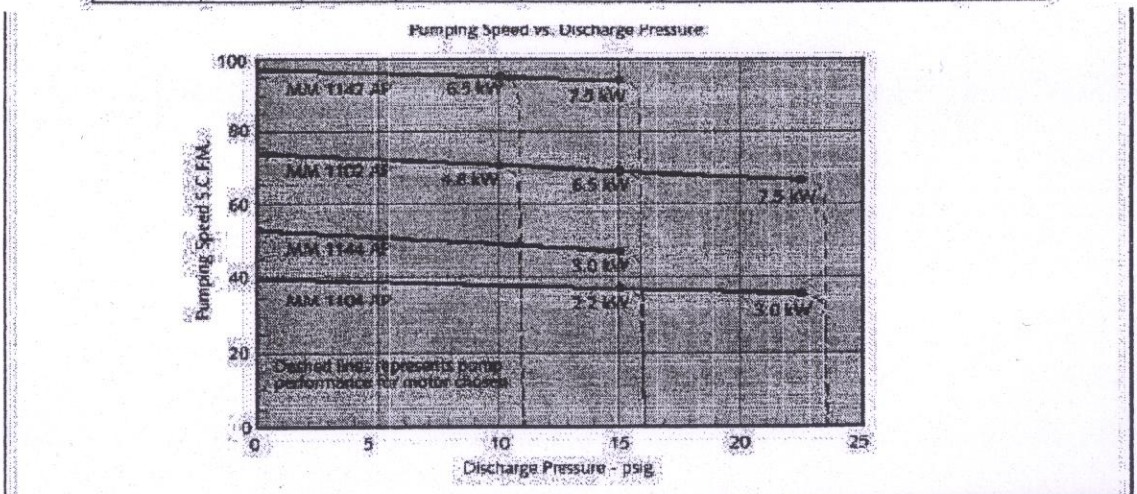
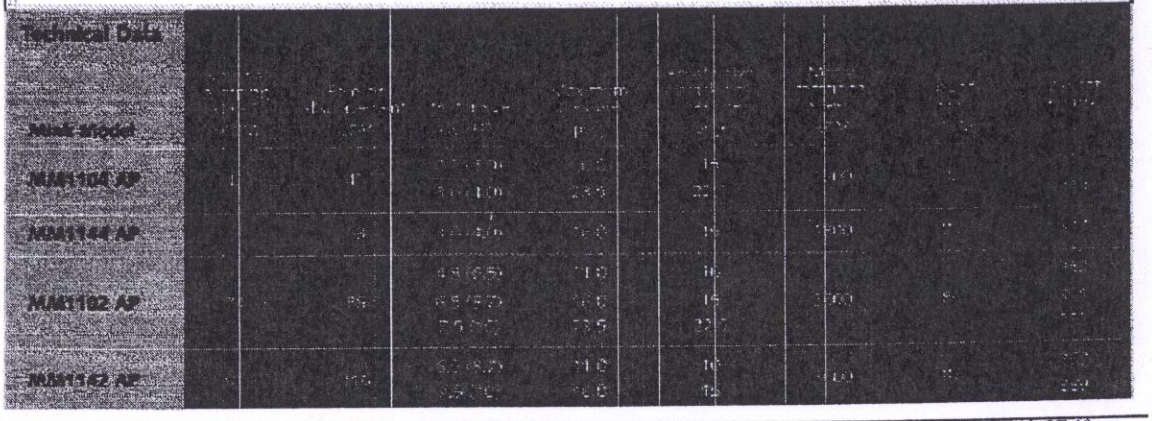
## Rotary Claw Vacuum Technology

| Type | Frequency [Hz] | Ultimate working pressure (bar (g)) | Nominal motor rating [kW] | Nominal speed [min⁻¹] | Volume flow [m³/h] | Sound pressure level (DIN 45635) with silencer [db(A)] | Weight [kg] |
|---|---|---|---|---|---|---|---|
| MM 1104 AP | 50 | 0.7 | 1.8 | 1500 | 62 | 76 | 147 |
| | | 1.0 | | | | | |
| | | 1.5 | 2.5 | | | | 150 |
| | 60 | 0.7 | 2.2 | 1800 | 75 | 81 | 147 |
| | | 1.0 | | | | | |
| | | 1.5 | 3.0 | | | | 150 |
| MM 1144 AP | 50 | 0.7 | 2.5 | 1500 | 78 | 76 | 153 |
| | | 1.0 | | | | | |
| | 60 | 0.7 | 3.0 | 1800 | 96 | 81 | |
| | | 1.0 | | | | | |
| MM 1102 AP | 50 | 0.7 | 4.0 | 3000 | 105 | 81 | 159 |
| | | 1.0 | 5.5 | | | | 164 |
| | | 1.5 | | | | | 162 |
| | 60 | 0.7 | 4.8 | 3600 | 135 | 85 | 159 |
| | | 1.0 | 6.5 | | | | 164 |
| | | 1.5 | 7.5 | | | | 174 |
| MM 1142 AP | 50 | 0.7 | 5.5 | 3000 | 140 | 81 | 167 |
| | | 1.0 | 5.5 | | | | 165 |
| | 60 | 0.7 | 6.5 | 3600 | 175 | 85 | 167 |
| | | 1.0 | 7.5 | | | | 177 |



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Clayton GROUP SERVICES
3140 Finley Road, Downers Grove, IL 60515
(630) 795-3200 Fax (630) 795-1130

SHEET NO. 1 OF 1
PROJECT 15-03095.13-001
DATE 8/4/04
BY BKM CKD

Hartford Working Group
TPH (as gasoline) Extraction Calculations

TPH Removal Rate

$$R_r = C_v \times Q \times MW \times 1.581 \times 10^{-7}$$

$C_v$ = Hydrocarbon (TPH) concentration in ppmV

$Q$ = Flow rate in $ft^3/min$

MW = molecular weight of gasoline

$C_v$ = 430 ppmv (highest air sample result)

$Q$ = 60 $ft^3/min$ (average flow rate)

MW = 66 lb./lb-mole

$$R_r = 430 \times 60 \times 66 \times 1.581 \times 10^{-7}$$

$$= 0.27 \text{ lb/hr.}$$

$$= 6.48 \text{ lb/day}$$

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
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# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 06/22/04 |
| Address: | 3140 Finley Road | Date Received: | 06/03/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401176 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15-03095.13-001

---

One (1) Tedlar Bag Sample labeled: "Effluent #1 / 6-2-04"

---

The sample was received at the laboratory under chain of custody on June 3, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheet. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095.13-001**

CAS Project ID: P2401176

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 6/2/04
Date Received: 6/3/04
Date Analyzed: 6/3/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| Effluent #1 / 6-2-04 | P2401176-001 | 1.00 | **73** | 18 | **21** | 5.1 | |
| Method Blank | P040603-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: KuH Date: 6/17/04

**Columbia Analytical Services, Inc.**

**Sample Acceptance Check Form**

Client: Clayton Group Services  Work order: P2401176

Project: Hartford Working Group/15-03095.13-001

Sample(s) received on: 6/3/04  Date opened: 6/3/04  by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401176-001 | | | NA | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Explain any discrepancies: (include lab sample ID numbers): _____

Columbia Analytical Services INC.
An Employee - Owned Company

**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: Clayton Group Services, 3140 Finley Rd, Downers Grove IL 60515 | Project Name: Hartford Working Group | Analysis | CAS Project No.: P2401176 |
| Phone: (630) 795-3200 Fax: (630) 795-1130 | Project Number: 15-03095.13-001 | | Cooler / Blank: Temp_____ |
| Email: BMartin@Claytongrp.com | Sampling Location: Hartford, IL | | |
| Contact: B. Martin | Sampler (Signature): | P.O. #/Billing Information: | |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH Gasoline | | | | Expected Turnaround Time: 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | Comments (e.g., preservative or specific instructions) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent #1/6.2.04 | 6.2.04 | 1405 | — | Air | — | — | 1L | X | | | | | |

| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | Additional Comments |
|---|---|---|---|---|---|---|
| | 6.2.04 | 1930 | Aharon Malone | 6/3/04 | 11:00 | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |

White Copy: Accompanies Sample

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
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# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 06/29/04 |
| Address: | 3140 Finley Road | Date Received: | 06/08/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401205 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group MPE Pilot Test/15-03095.13-001

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One (1) Tedlar Bag Sample labeled: "Exhaust #2"

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The sample was received at the laboratory under chain of custody on June 8, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Methane Analysis

The sample was analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheet. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group MPE Pilot Test/15-03095.13-001** CAS Project ID: P2401205

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 6/7/04
Date Received: 6/8/04
Date Analyzed: 6/8/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| Exhaust #2 | P2401205-001 | 1.00 | **42** | 0.50 | |
| Exhaust #2 | P2401205-001DUP | 1.00 | **42** | 0.50 | |
| Method Blank | P040608-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KLH Date: 06/22/04

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group MPE Pilot Test/15-03095.13-001** CAS Project ID: P2401205

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 6/7/04
Date Received: 6/8/04
Date Analyzed: 6/8/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| Exhaust #2 | P2401205-001 | 1.00 | **87** | 18 | **25** | 5.1 | |
| Method Blank | P040608-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: KMH Date: 06/22/04

**Columbia Analytical Services, Inc.**
**Sample Acceptance Check Form**

Client: Clayton Group Services Work order: P2401205

Project: Hartford Working Group MPE Pilot Test/15-03095.13-001

Sample(s) received on: 6/8/04 Date opened: 6/8/04 by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401205-001 | | | NA | |
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Explain any discrepancies: (include lab sample ID numbers):

Columbia Analytical Services INC.
An Employee - Owned Company

**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: Clayton Group Services, Inc. 3140 Finley Rd. Downers Grove, IL 60515 | Project Name: Hartford Working Group MPE Pilot Test | Analysis | CAS Project No.: P2401205 |
| | Project Number: 15-03095.13-001 | | |
| Phone: 630-795-3200 Fax: 630-795-1130 | Sampling Location: Exhaust | | Cooler / Blank Temp_____ |
| Email: bmartin@claytongrp.com | P.O. #/Billing Information | | |
| Contact: Brad Martin | Sampler (Signature): Brad Martin | | Comments (e.g., preservative or specific instructions) |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH Gasoline | Methane | | | Expected Turnaround Time: 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exhaust #2 | 6/7/04 | 15:30 | | AIR | 023523-0002 | 232-01 | 1 | ✓ | ✓ | | | |

| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: |
|---|---|---|---|---|---|
| Brad Martin | 6/7/04 | 16:30 | FED-EX → COLUMBIA | | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: |
| | | | Sharon Malone | 6/8/04 | 0930 |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: |

Additional Comments

White Copy: Accompanies Samples — Yellow Copy: Retained by Client — COC #13-7/03

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Columbia Analytical Services INC.
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# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 07/07/04 |
| Address: | 3140 Finley Road | Date Received: | 06/18/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401304 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15-03095.13-001

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One (1) Tedlar Bag Sample labeled: "Exhaust #3"

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The sample was received at the laboratory under chain of custody on June 18, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Methane Analysis

The sample was also analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

Reviewed and Approved:

Chris Parnell
GCMS-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095.13-001**

CAS Project ID: P2401304

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890 II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 6/17/04
Date Received: 6/18/04
Date Analyzed: 6/18/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** mg/m³ | MRL mg/m³ | **Result** ppmV | MRL ppmV | |
| Exhaust #3 | P2401304-001 | 1.00 | **870** | 18 | **250** | 5.1 | |
| Method Blank | P040618-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: KLH Date: 07/01/04

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095.13-001** CAS Project ID: P2401304

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Wade Henton/Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 6/17/04
Date Received: 6/18/04
Date Analyzed: 6/18/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| Exhaust #3 | P2401304-001 | 1.00 | **47** | 0.50 | |
| Exhaust #3 | P2401304-001DUP | 1.00 | **47** | 0.50 | |
| Method Blank | P040618-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KLH Date: 07/01/04

**Columbia Analytical Services, Inc.**
**Sample Acceptance Check Form**

Client: Clayton Group Services Work order: P2401304

Project: Hartford Working Group/15-03095.13-001

Sample(s) received on: 1/4/03 Date opened: 1/4/03 by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401304-001 | | | NA | |
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Explain any discrepancies: (include lab sample ID numbers):

Columbia Analytical Services INC.
An Employee - Owned Company

**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: CLAYTON GROUP SERVICES, 3140 FINLEY ROAD, DOWNERS GROVE, IL 60515 | Project Name: HARTFORD WORKING GROUP | Analysis | CAS Project No.: P2401304 |
| | Project Number: 15-03095.13-001 | | |
| Phone: (630) 795-3200 Fax: (630) 795-1130 | Sampling Location: HARTFORD, IL | | Cooler / Blank |
| Email: | P.O. #/Billing Information: | | Temp_____ |
| Contact: BRAD MARTIN | Sampler (Signature): | | |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH GASOLINE | METHANE | | | Expected Turnaround Time: 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | Comments (e.g., preservative or specific instructions) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXHAUST #3 | 6/17/04 | 1345 | | AIR | | | 1 | X | X | | | | |

| | Date: | Time: | Received by: (Signature) | Date: | Time: | Additional Comments |
|---|---|---|---|---|---|---|
| Relinquished by: (Signature) | 6/17/04 | 1345 | Sharon Malone | 6/18/04 | 11:00 | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |

White Copy: Accompanies Samples — Yellow Copy: Retained by Client — COC #13 7/03

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Columbia Analytical Services INC.
An Employee - Owned Company

# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 07/13/04 |
| Address: | 3140 Finley Road | Date Received: | 06/24/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401345 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15.03095.13-001

---

One (1) Tedlar Bag Sample labeled: "EXHAUST #4"

---

The sample was received at the laboratory under chain of custody on June 24, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Methane Analysis

The sample was analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was also analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15.03095.13-001** CAS Project ID: P2401345

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Wade Henton/Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 6/23/04
Date Received: 6/24/04
Date Analyzed: 6/24/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| EXHAUST #4 | P2401345-001 | 1.00 | **46** | 0.50 | |
| Method Blank | P040624-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: RG Date: 7/9/04

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15.03095.13-001**

CAS Project ID: P2401345

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890 II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 6/23/04
Date Received: 6/24/04
Date Analyzed: 6/25/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| EXHAUST #4 | P2401345-001 | 1.00 | **1,500** | 18 | **420** | 5.1 | |
| EXHAUST #4 | P2401345-001DUP | 1.00 | **1,500** | 18 | **430** | 5.1 | |
| Method Blank | P040625-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: RCr Date: 7/9/04

**Columbia Analytical Services, Inc.**
**Sample Acceptance Check Form**

Client: Clayton Group Services Work order: P2401345

Project: Hartford Working Group/15.03095.13-001

Sample(s) received on: 6/24/04 Date opened: 6/24/04 by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401345-001 | | | NA | |
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Explain any discrepancies: (include lab sample ID numbers):

Columbia Analytical Services INC.
An Employee - Owned Company

**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
## Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: Clayton Group Services, 3140 Finley Rd, Downers Grove, IL 60515 | Project Name: Hartford Working Group | Analysis | CAS Project No.: P2401345 |
| Phone: (630) 795-3200 Fax: (630) 795-1130 | Project Number: 15.03095.13-001 | | Cooler / Blank |
| Email | Sampling Location: Hartford, IL | | Temp |
| Contact: Brad Martin | Sampler (Signature) | P.O. #/Billing Information | Comments (e.g., preservative or specific instructions) |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH Gasoline | Methane | | | Expected Turnaround Time: 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exhaust #4 | 6/23/04 | 1210 | | Air | | | 1 | X | X | | | | |

| | Date: | Time: | Received by: (Signature) | Date: | Time: | Additional Comments |
|---|---|---|---|---|---|---|
| Relinquished by: (Signature) | 6/23/04 | 1215 | Aharon Malone | 6/24/04 | 1135 | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |

White Copy: Accompanies Samples — Yellow Copy: Retained by Client — COC #13-7/03

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
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# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 07/30/04 |
| Address: | 3140 Finley Road | Date Received: | 07/16/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401504 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15-03095-13-001

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One (1) Tedlar Bag Sample labeled: "EXHAUST #5"

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The sample was received at the laboratory under chain of custody on July 16, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Methane Analysis

The sample was also analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095-13-001**

CAS Project ID: P2401504

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890 II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 7/15/04
Date Received: 7/16/04
Date Analyzed: 7/16/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| EXHAUST #5 | P2401504-001 | 1.00 | **560** | 18 | **160** | 5.1 | |
| Method Blank | P040716-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: KMH Date: 07/29/04

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095-13-001**

CAS Project ID: P2401504

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Wade Henton
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 7/15/04
Date Received: 7/16/04
Date Analyzed: 7/16/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| EXHAUST #5 | P2401504-001 | 1.00 | **20** | 0.50 | |
| EXHAUST #5 | P2401504-001DUP | 1.00 | **20** | 0.50 | |
| Method Blank | P040716-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KMH Date: 07/29/04

**Columbia Analytical Services, Inc.**

**Sample Acceptance Check Form**

Client: Clayton Group Services Work order: P2401504

Project: Hartford Working Group/15-03095-13-001

Sample(s) received on: 7/16/04 Date opened: 7/16/04 by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401504-001 | | | NA | |
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Explain any discrepancies: (include lab sample ID numbers):

Columbia Analytical Services INC.
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**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: CLAYTON GROUP SERVICES, 3140 FINLEY RD, DOWNERS GROVE, IL 60515 | Project Name: HARTFORD WORKING GROUP | Analysis | CAS Project No.: P2401504 |
| Phone: (630) 795-3200 Fax: | Project Number: 15-03095.13-001 | | Cooler / Blank: Temp_____ |
| Email: | Sampling Location: HARTFORD IL | | |
| Contact: BRAD MARTIN. Sampler (Signature): | P.O. #/Billing Information: | | Comments (e.g., preservative or specific instructions) |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH GASOLINE | METHANE | | | Expected Turnaround Time 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXHAUST #5 | 7/15/04 | 1415 | | AIR | | | 1L | X | X | | | | |

| | Date: | Time: | | Date: | Time: | |
|---|---|---|---|---|---|---|
| Relinquished by: (Signature) | 7/15/04 | 1415 | Received by: (Signature) Sharon Malone | 7/16/04 | 10:00 | Additional Comments |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |

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Columbia Analytical Services INC.
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# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 08/11/04 |
| Address: | 3140 Finley Road | Date Received: | 07/23/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401554 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15.03095.13-001

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One (1) Tedlar Bag Sample labeled: "EXHAUST #6"

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The sample was received at the laboratory under chain of custody on July 23, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Methane Analysis

The sample was analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was also analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

Reviewed and Approved:

John Yokoyama
Operations Manager
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15.03095.13-001**
CAS Project ID: P2401554

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Wade Henton
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 7/22/04
Date Received: 7/23/04
Date Analyzed: 7/23/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| EXHAUST #6 | P2401554-001 | 1.00 | **15** | 0.50 | |
| Method Blank | P040723-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KMH Date: 08/06/04

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15.03095.13-001**

CAS Project ID: P2401554

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC11/FID
Analyst: Wade Henton
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 7/22/04
Date Received: 7/23/04
Date Analyzed: 7/23/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| EXHAUST #6 | P2401554-001 | 1.00 | **140** | 18 | **40** | 5.1 | |
| Method Blank | P040723-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit.**
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: KMH Date: 08/06/04

**Columbia Analytical Services, Inc.**

**Sample Acceptance Check Form**

Client: Clayton Group Services  Work order: P2401554

Project: Hartford Working Group/15.03095.13-001

Sample(s) received on: 7/23/04  Date opened: 7/23/04  by: LC

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? _____ | Sealing Lid? | ☐ | ☒ | ☐ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401554-001 | | | NA | |
| | | | | |
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Explain any discrepancies: (include lab sample ID numbers): _____

Columbia Analytical Services INC.
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Air Quality Laboratory
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

ent/Address
CLAYTON GROUP SERVICES
3140 FINLEY RD.
DOWNERS GROVE, IL 60515

one (630) 795-3200 Fax (630) 795-1130

ail bmartin@claytongrp.com

ntact RAD MARTIN

Sampler (Signature)

Project Name: HARTFORD WORKING GROUP

Project Number: 15-03095.13-001

Sampling Location: HARTFORD, IL

P.O. #/Billing Information

CAS Project No.: P2401554

Cooler / Blank

Temp_____

Analysis

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH GASOLINE | METHANE | | | Expected Turnaround Time 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | Comments (e.g., preservative or specific instructions) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXHAUST #6 | 7/22/04 | 1040 | 001 | AIR | | | 1L | X | X | | | | |

| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | Additional Comments |
|---|---|---|---|---|---|---|
| | 7/22/04 | 1100 | | 7-23-04 | 9:30 | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | |

2665 Park Center Drive, Suite D Simi Valley, California 93065 (805) 526-7161 ph (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

# LABORATORY REPORT

| | | | |
|---|---|---|---|
| Client: | CLAYTON GROUP SERVICES | Date of Report: | 08/18/04 |
| Address: | 3140 Finley Road | Date Received: | 07/30/04 |
| | Downers Grove, IL 60515 | CAS Project No: | P2401631 |
| Contact: | Mr. Brad Martin | Purchase Order: | Verbal |

Client Project ID: Hartford Working Group/15-03095.13-001

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One (1) Tedlar Bag Sample labeled: "EXHAUST #7"

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The sample was received at the laboratory under chain of custody on July 30, 2004. The sample was received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time that it was received at the laboratory.

Total Petroleum Hydrocarbons as Gasoline Analysis

The sample was analyzed for total petroleum hydrocarbons as gasoline per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

Methane Analysis

The sample was also analyzed for methane per modified EPA Method TO-3 using a gas chromatograph equipped with a flame ionization detector (FID).

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

---

Reviewed and Approved:

Regan Lau
Analytical Chemist
Air Quality Laboratory

Reviewed and Approved:

Wade Henton
GC-VOA Team Leader
Air Quality Laboratory

# COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS



**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095.13-001**

CAS Project ID: P2401631

## Methane

Test Code: Modified EPA TO-3
Instrument ID: HP5890II/GC8/FID
Analyst: Wade Henton/Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date(s) Collected: 7/29/04
Date Received: 7/30/04
Date Analyzed: 7/30/04
Volume(s) Analyzed: 1.0 ml

| Client Sample ID | CAS Sample ID | D.F. | Methane Concentration in ppmV | | Data Qualifier |
|---|---|---|---|---|---|
| | | | Result | MRL | |
| EXHAUST #7 | P2401631-001 | 1.00 | **16** | 0.50 | |
| Method Blank | P040730-MB | 1.00 | ND | 0.50 | |

ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: RG Date: 8/3/04

**Client:** **Clayton Group Services**
**Client Project ID:** **Hartford Working Group/15-03095.13-001**

CAS Project ID: P2401631

## Total Petroleum Hydrocarbon (TPH)

Test Code: Modified EPA TO-3
Instrument ID: HP5890 II/GC11/FID
Analyst: Regan Lau
Sampling Media: Tedlar Bag(s)
Test Notes:

Date Collected: 7/29/04
Date Received: 7/30/04
Date Analyzed: 7/30/04
Volume(s) Analyzed: 1.00 ml

| Client Sample ID | CAS Sample ID | D. F. | Total Petroleum Hydrocarbons as Gasoline | | | | Data Qualifier |
|---|---|---|---|---|---|---|---|
| | | | **Result** | MRL | **Result** | MRL | |
| | | | **mg/m³** | mg/m³ | **ppmV** | ppmV | |
| EXHAUST #7 | P2401631-001 | 1.00 | **190** | 18 | **53** | 5.1 | |
| Method Blank | P040730-MB | 1.00 | ND | 18 | ND | 5.1 | |

Parts Per Million Results Are Based on a Molecular Weight of 86.18
ND = Compound was analyzed for, but not detected above the **laboratory reporting limit**.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.



Verified By: RC Date: 8/13/04

**Columbia Analytical Services, Inc.**
**Sample Acceptance Check Form**

Client: Clayton Group Services Work order: P2401631

Project: Hartford Working Group/15-03095.13-001

Sample(s) received on: 7/30/04 Date opened: 7/30/04 by: SM

***Note:*** This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

| | | | Yes | No | N/A |
|---|---|---|---|---|---|
| 1 | Were **custody seals** on outside of cooler/Box? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| | Were custody seals on outside of sample container? | | ☐ | ☒ | ☐ |
| | Location of seal(s)? | Sealing Lid? | ☐ | ☐ | ☒ |
| | Were signature and date included? | | ☐ | ☐ | ☒ |
| | Were seals intact? | | ☐ | ☐ | ☒ |
| 2 | Were **sample containers** properly marked with client sample ID? | | ☒ | ☐ | ☐ |
| 3 | Did **sample containers** arrive in good condition? | | ☒ | ☐ | ☐ |
| 4 | Were **chain-of-custody** papers used and filled out? | | ☒ | ☐ | ☐ |
| 5 | Did **sample container labels** and/or tags agree with custody papers? | | ☒ | ☐ | ☐ |
| 6 | Was **sample volume** received adequate for analysis? | | ☒ | ☐ | ☐ |
| 7 | Are samples within specified holding times? | | ☒ | ☐ | ☐ |
| 8 | Was proper **temperature** (thermal preservation) of cooler at receipt adhered to? | | ☐ | ☐ | ☒ |
| | Cooler Temperature NA °C | | | | |
| | Blank Temperature NA °C | | | | |
| 9 | Is pH (acid) **preservation** necessary, according to method/SOP or Client specified information? | | ☐ | ☒ | ☐ |
| | Is there a client indication that the submitted samples are **pH** (acid) preserved? | | ☐ | ☐ | ☒ |
| | Were **VOA vials** checked for presence/absence of air bubbles? | | ☐ | ☐ | ☒ |
| | Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it? | | ☐ | ☐ | ☒ |
| 10 | **Tubes:** Are the tubes capped and intact? | | ☐ | ☐ | ☒ |
| | Do they contain moisture? | | ☐ | ☐ | ☒ |
| 11 | **Badges:** Are the badges properly capped and intact? | | ☐ | ☐ | ☒ |
| | Are dual bed badges separated and individually capped and intact? | | ☐ | ☐ | ☒ |

| Lab Sample ID | Required pH | pH (as received, if required) | VOA Headspace (Presence/Absence) | Receipt / Preservation Comments |
|---|---|---|---|---|
| P2401631-001 | | | NA | |
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Explain any discrepancies: (include lab sample ID numbers):

Columbia Analytical Services INC.
An Employee - Owned Company

**Air Quality Laboratory**
2665 Park Center Drive, Suite D
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

# Chain of Custody Record
# Analytical Service Request

| | | | |
|---|---|---|---|
| Client/Address: CLAYTON GROUP SERVICES, 3140 FINLEY RD, DOWNERS GROVE, IL 60515 | Project Name: HARTFORD WORKING GROUP | Analysis | CAS Project No.: P2401631 |
| | Project Number: 15-03095.13-001 | | |
| Phone: (630) 795-3200 Fax: (630) 795-1130 | Sampling Location: HARTFORD, IL | | Cooler / Blank |
| Email: bmartin@claytongrp.com | P.O. #/Billing Information | | Temp_____ |
| Contact: BRAD MARTIN Sampler (Signature): | | | Comments (e.g., preservative or specific instructions) |

| Client Sample ID | Date Collected | Time Collected | Lab Sample No. | Type of Sample | Container ID (Serial #) | Flow Controller (Serial #) | Sample Volume (Liters) | TPH GASOLINE | METHANE | | | Expected Turnaround Time 24 Hr 48Hr 3Day 4Day 5Day Standard (10 Business Days) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXHAUST #7 | 7/29/04 | 1315 | | AIR | | | 1L | X | X | | | | |

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|---|---|---|---|---|---|---|---|
| Relinquished by: (Signature) | Date: 7/29/04 | Time: 1400 | Received by: (Signature) Sharon Malone | Date: 7/30/04 | Time: 1040 | Additional Comments | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | | |
| Relinquished by: (Signature) | Date: | Time: | Received by: (Signature) | Date: | Time: | | |

White Copy: Accompanies Samples — Yellow Copy: Retained by Client — COC #13 7/02